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CONTRIBUTIONS:

All Letters and Contributions intended for Publication should be addressed to:—
K. R. DOGGETT, Editor,
"The Dock and Harbour Authority,"
19, Harcourt Street, London, W.1,
Telephone: PADdington 0077/8.

The Dock & Harbour Authority

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Editorial Comments

The Port of Montevideo.

Montevideo, the principal port and capital of the Republic of Uruguay, with a population of nearly three-quarters-of-a-million is situated at the mouth of the River Plate, and owing to its favourable geographical position, is a natural port of call for all shipping visiting the South-West Coast of South America. Its sheltered situation also affords protection to vessels seeking refuge from the southerly and westerly gales. The port has a most important transit trade, and a large volume of goods destined for the neighbouring Republics of Paraguay, Bolivia and Brazil are transhipped every year.

In view of the controversy that has been roused in this country by the nationalisation plans contained in the Transport Act, and the inclusion of the ports of the United Kingdom in a far-reaching scheme of legislation, it is interesting to note that the administrative status of the Port of Montevideo underwent similar change as far back as 1916, when the old system of jurisdiction under a Board of Directors was replaced by State control, and all services such as loading and unloading and the handling of merchandise were nationalised.

The City has a history extending back to 1726, the date of its foundation by Don Mauricio Zabala, govenor at that time of Buenos Aires, his object being to arrest the penetration of the Portuguese adventurers on the left bank of the La Plata River. As a matter of fact, a small military post of no significance had existed there since 1717. The first settlers at the port came from the Canary Islands. Growth at first was slow, but in 1778, when the place became a free port, trade increased rapidly. It was captured by a British expedition in 1807, but shortly afterwards was abandoned as a British possession. It became the capital of the Republic of Uruguay in 1828.

An article describing the development of the port appeared in this Journal in the issue for February, 1932, and for the details of the progress that has been made since, we are indebted to Señor Hector Pochintesta, General Manager of the port, whose interesting account of the present facilities and the contemplated extensions will be found on another page.

Radar Navigation Developments.

Our last comment on the subject of Radar as an aid to marine navigation appeared in the May, 1947, issue of this Journal, and since then, there has been a number of developments, not only in this country, but also throughout the world.

A particularly interesting development in the United Kingdom, is the installation of Radar at Wallasey. The ferry vessels plying between Wallasey and Liverpool carry across the River Mersey some twenty million passengers a year, and hitherto, during periods of fog, the problem has been to maintain a reliable time schedule. A successful solution has now been found in Radar, and elsewhere in this issue our readers will find a description of the difficulties that had to be overcome, and details of the new installation which have been kindly supplied by Mr. L. D. Price, the General Manager of the Ferries Department of the Wallasey Corporation. Since this apparatus, which contains several novel features, was installed at Wallasey, a number of officials concerned in harbour and shipping administration have shown their interest, and full-scale demonstrations are being arranged to enable further investigations and experiments to be made.

Another development is the formation by the Ministry of Transport of a small group of operational research scientists to work in the field of radio aids to marine navigation. This group has two objects, first, to examine the performance and usefulness of particular pieces or types of apparatus under typical operational conditions, and secondly, to study general operational problems to determine how useful particular radio navigational aids are in improving the safety and general efficiency of merchant shipping. In addition a small research team is being set up at the Admiralty Signal Establishment to deal particularly with the requirements of merchant ships.

Finally, it is announced from Canada that the National Research Council and the Department of Transport are co-operating to determine what use can be made of radar at the entrances to ocean ports. Considerable work has already been done on this matter. The equipment now in use is situated at the Camperdown Signal Station overlooking the entrance to Halifax Harbour and has a range of 25 miles. The Sambro Light-vessel, anchored 11 miles distant from the station, is clearly visible at all times. Its position marks the approach channel for vessels inward bound from the south and west. The outer automatic gas buoy is also always clearly visible and marks the channel for vessels approaching from the east.

The height of the radar installation at the signal station is such that inbound vessels can be followed and plotted from a distance of 25 miles with extreme accuracy. An accuracy of $\pm$ 50 yards (radially) is obtainable to maximum range. It is therefore possible for the shore signalmen to report inbound vessels from a greater

Editorial Comments—continued

distance than was previously possible even in clear weather, and this condition exists during all types of inclement weather that previously prevented the reporting of inbound vessels completely. An additional attachment to this installation provides a continuous view of a harbour chart with a radar picture super-imposed upon it and all buoys are visible continuously on this super-imposed chart, so that the pilot vessel and ships can be plotted continuously as they proceed on different courses from buoy to buoy. Experimental co-operation is shortly to be started with the pilot vessel to provide information on the movement of ships as they approach the rendezvous.

Anomalies of Ship's Tonnage Measurement.

The international conference convened early last June to study the question of the unification of ships tonnage measurement was attended by delegates from eight maritime nations, representatives from Great Britain and the United States also being present but as observers only. At the conclusion of the conference, a convention was signed based upon the draft rules which were agreed at the meetings. These provide for the adoption of uniform rules for the measurement of ships tonnage for the purposes of registration and of port and canal dues.

As is well known, there have been several different measurement systems in the past, and although the present British method is the most widely used, there are other systems operated by Chile, Finland, Belgium and Sweden, each differing in some degree. In addition, all are subject to the special rules for assessing the charges for passing through the Panama and Suez Canals.

As pointed out by the Baltic and International Maritime Conference in their Monthly Circular for August last, the anomalies of tonnage measurement have been a matter of dissatisfaction among shipping interests for the past century or more, and as early as 1862, a memorandum was published in the United Kingdom by the Board of Trade which read as follows: " If one system could be adopted by all maritime nations so that the capacity of any given ship, when once officially ascertained and denoted on her official papers, could be everywhere understood and recognised as valid, the advantages gained would be very great. The statistics of navigation would be rendered more simple, intelligible and accurate. The merchant or shipowner would at once understand the size and capacity of the ship he employs or purchases; he would also escape the annoyance and expense of measurement; and lastly, taxation, when imposed, would be rendered more simple and more just. Under these circumstances there can be but one opinion as to the utility, if not the necessity of some general system of measuring merchant shipping."

It will be remembered that just before the recent war, a set of draft rules was published, based largely on the British system, and the Conference held last June, resumed the study of the question from that point. The new convention, which will, of course, have to be ratified by the Governments concerned, is so worded that the tonnage measurement rules can, if necessary, be altered by agreement, and in order to ensure uniform application, it is proposed that meetings shall be held at least once every two years.

There is no question that radical reforms are long overdue, and all concerned with the operation of shipping, and more especially, with the charging of port and harbour dues, will hope that all maritime nations will ratify the proposals agreed thus far, so that the much-needed improvements can be carried into effect.

Poland's Coal Export Programme.

An interesting account of the present position of Gdynia and Gdansk, the two main ports of Poland, has been received from a leading British port official who recently visited that country at the request of the Polish Government, in order to advise them on port facilities, and more particularly on coal shipping appliances.

Both Gdynia and Gdansk as is well known were subjected to extreme damage and sabotage during the war, and owing to the universal shortage of materials and equipment, their rate of recovery will of necessity be very slow. A large number of appliances were either confiscated by the Nazis and removed or completely demolished, and it has been necessary to incorporate what remained in the building up of improvised new machines. These machines are therefore much below standard requirements, while those still in commission have been and are being seriously overworked with an inadequate attention to maintenance. In spite of all handicaps, however, these two ports are now handling coal shipments approaching in volume about half their pre-war figure

A number of 7-ton coal cranes are on order, and if these can be installed in time, it is hoped that by the end of 1948 a coal export figure of 11,000,000 tons will be reached. This is about equal to the total exported in 1938. For 1950, they have a target of 17,000,000 tons, and they are planning for an eventual target of 40,000,000 tons.

This latter figure will come as a disagreeable surprise to South Wales coal exporters, now the National Coal Board, when it is realised that it is the same as the tonnage shipped from South Wales ports in 1913, when the export of coal from those ports was at its peak.

It emphasises once again—if such emphasis is necessary—the paramount importance of sufficient coal being mined in this country, and South Wales in particular, to allow an early resumption of the export trade in such volume as will ensure to Great Britain its rightful share of the World's markets.

German Traffic Diversion to North Sea Ports.

Following the comment on this subject which appeared last month in these columns, it has now been reported from Washington that it has become necessary to negotiate a new agreement to replace the one arrived at in July last between the United States, Britain, Holland and Belgium. This provided for the diversion of a number of cargo ships from the German ports of Bremen and Hamburg to the Dutch and Belgian ports of Rotterdam and Antwerp respectively. The new arrangement has had to be made because a miscalculation produced incorrect figures which led those conducting the negotiations to believe there would be a much larger saving of dollars than actually was the case. A new agreement is expected to be reached in the near future, following which it will probably take some weeks before the necessary arrangements to divert shipping can be made. Estimated quantities of 1,700,000 tons of cargo per annum are involved, representing about 40 per cent. of the cargo (chiefly cereals) despatched to Germany from the United States.

Proposed Free Port in Panama Canal Zone.

The establishment of a Free Port or Foreign Trade Zone in the neighbourhood of the Panama Canal is advocated in a recently issued report by Mr. Thos. E. Lyons, executive secretary of the United States Foreign Trade Zone Board. Mr. Lyons, who has investigated the need for such a zone in Panama, states that in addition to benefiting business in Panama and the Canal Zone, the establishment of the proposed free port area would be of assistance to the foreign trade and shipping interests of the United States. He is also of opinion that it would promote the development of air cargo and passenger traffic, and provide an incentive for greater use of the canal by shipping, thereby increasing the number of actual canal transits. He recommends that the Foreign Trade Zone should be located near the Cristobal Mole in Colon Harbour.

The St. Lawrence Seaway.

A further step has been taken in the advancement of the project for a deep-water seaway connecting the Great Lakes of North America with the Atlantic Ocean by way of the River St. Lawrence. Legislation to authorise its construction has been approved by a sub-committee of the Foreign Relations Committee of the United States Senate. No further action, however, is expected to be taken as regards legislation until the Senate resumes session in January, 1948, when the enabling Bill will be presented.

It has been stated by Lieut.-General R. A. Wheeler in evidence before the Public Works Committee of the House of Representatives that the Seaway will cost $674,000,000 to complete, of which the United States would pay $491,000,000 and Canada $183,000,000.

The Port of Montevideo

Principal Port of the Uruguayan Republic

By HECTOR POCHINTESTA, General Manager of the Port.

THE Port of Montevideo lies in latitude 34° 54′ 33″ South and in longitude 56° 12′ 45″ West of the Greenwich meridian. It is located in the estuary of the Rio de la Plata and is the principal port and capital of the Republic of Uruguay.

Historical Notes

Traditionally seamen have recognised Montevideo as a point of easy and necessary accessibility in the charts of the River La Plata. Its classification as a port of the first rank is due to natural circumstances and is immutable and definite on account of its situation between fresh and salt water, between great and moderate depths, between the river and the sea.

During the period of Spanish dominion, the roadstead of Montevideo was the point of transhipment of numerous passengers, and much merchandise, since sailing ships of regular draught could only with difficulty ascend the rivers Uruguay and Parana and even enter the River La Plata. At that time, as also for a long subsequent period, Montevideo was the port of arrival and refuge, the first safe port on the great ocean routes, the final destinations of which were the Gulf of St. Catalina and the Eastern seaboard of the Republic.

The majority of vessels seek the shelter of the Point de San José from southern gales and withstand those from the west by means of double and triple cables. Gone for ever are the times in which on days of storm, while the winds swept over the buildings, closed the quays and uprooted the trees in ancient gardens, hundreds of people flocked to the shore to watch the spectacle of the sea with shipping lined away to the offing, their sails close reefed and their engines ready to avoid catastrophe. Such was the condition of the picture offered at the harbour of Montevideo up to the year 1900.

The Present Situation

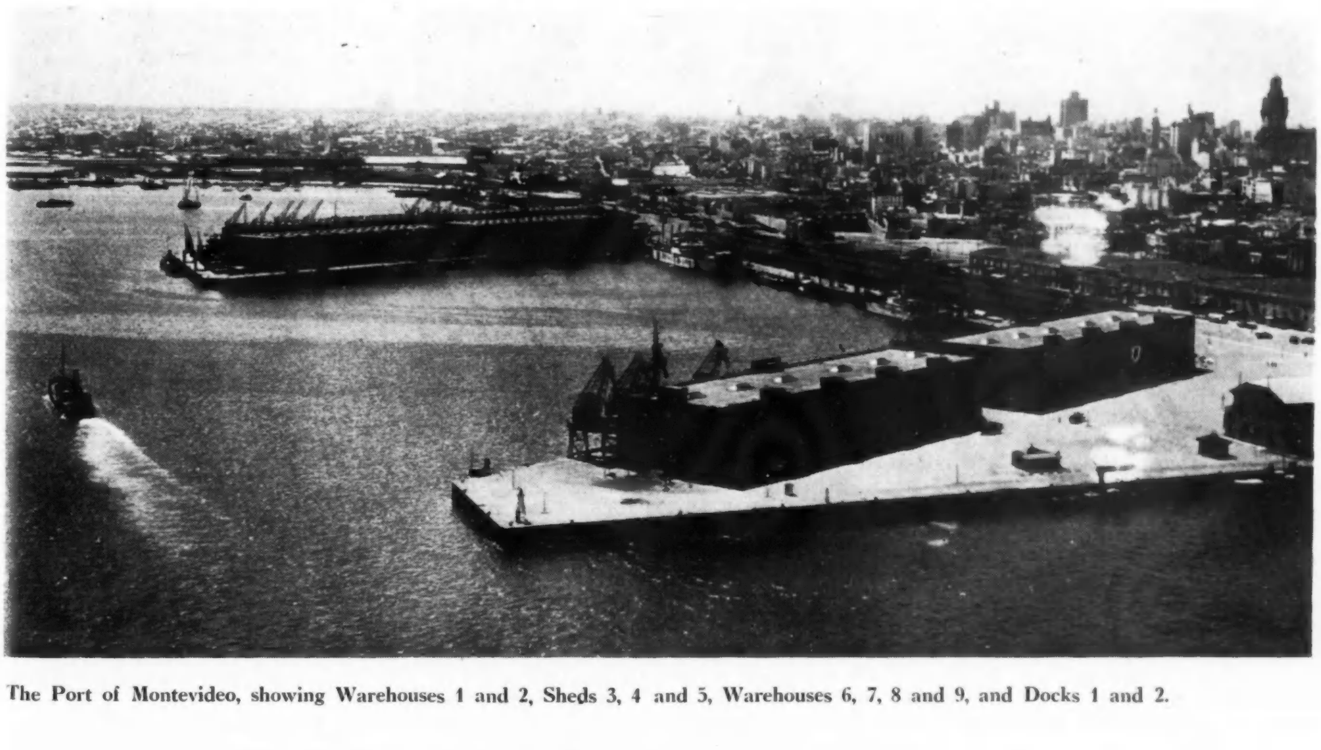
From that epoch to the present, the Oriental Republic of the Uruguay has sensibly progressed. Its advance has been constant in all directions. Its social progress is substantial. It has passed laws which are a model of liberty and it is considered and recognised as one of the most advanced countries in its positive legislation.

The services of the port are State controlled. In 1910 the artificial works of the harbour were placed in commission. Actually the direction and administration are entrusted to an honorary directorate, whose jurisdiction extends to all the harbours of the Republic. This directorate of ten members consists of delegates of the Government, representatives of the National Chamber of Commerce, the Institution of Transatlantic Navigation, the Mercantile Chamber of County Products and the chief officers of Customs, the General Port Administration and the Directorate of Hydrography and Engineering.

The value of the hereditament at the present time, including protective works, deepening works, quays, fillings, warehouses and other installations and equipment, including floating plant (tugs, launches, dredgers, etc.) amounts approximately to 50 million dollars, which figure in relation to actual value can be considered very low.

Approaching completion is a large building, to house the offices of the Directorate of Ports, which is rising near the entrance of the harbour. There is also nearing completion Warehouse A on the riverside quay and the Warehouses or Sheds 22 and 25 in the coastwise zone.

In consequence of the termination of the war and the return to normal of maritime activities, the Port of Montevideo has witnessed a notable increase in its operations, which has given



The Port of Montevideo, showing Warehouses 1 and 2, Sheds 3, 4 and 5, Warehouses 6, 7, 8 and 9, and Docks 1 and 2.

Port of Montevideo—continued

occasion to the higher authority to consider an important programme of extension works and installations.

Essentially there has been presented to the Government a programme involving the expenditure of 50 million dollars (Uruguayan currency), which includes the construction of new quays, warehouses, docks and the acquisition of working equipment, such as cranes, winches, transporters, locomotives, etc.

The execution of this programme is estimated to take 10 years. In the plan on page 143 are shown the existing installations at the harbour, also the projects for the 10 year period; moreover they indicate some extensions in a more distant future, which call for later consideration. The works of the first stage are shown hatched and at the end of this article is a schedule of the items involved, with reference letters to the plan.

Aerial View of the Port of Montevideo, showing Docks 1 and 2 and Jetties A and B. In the foreground is the terminus of the State Railway, and behind, is the main building of the Customs.

The plan also shows (dotted lines) a future enlargement project with considerable scope, which foresees new quays and docks, industrial zones, dry docks, naval bases, etc.

The approach to the Port of Montevideo from the deep water of the estuary is formed by a channel of 10 kilometres in a south-north direction, which is dredged to a depth of 10 metres below zero, which is the level of mean sea + .75 m. The principal works of protection are formed of rubble mounds and breakwaters; those of the East and West are 900 metres and 1,300 metres long respectively, which enclose an outer harbour of some 80 hectares approximately, including the approach to the commercial docks. The area of the docks, with depths maintained at —10 metres in the commercial harbour, amounts to some 40 hectares. The petroleum docks, which serve the needs of the National Administration of Combustibles, Alcohol and Portland, are kept dredged connected by a channel at 9.50 metres minimum depth and have a surface of approximately 8 hectares.

The Port of Montevideo has capacity for the realisation of the operations inherent in traffic both overseas and fluvial, possessing 10 quays for the former with a total length of 2,266 metres, which cover an area of 78,395 square metres.

Within the area referred to and as regards the former traffic with operations of importation, exportation and transit and reshipment, it is equipped with all the necessary appliances for loading and discharge of vessels by means of cranes and winches, efficient units which facilitate and make possible the realisation of operations within the average time of all ports which work on the basis of identical procedure in loading and unloading. These elements of loading and unloading—to-day insufficient—are in course of being shortly augmented to a sensible extent, for which purpose several different acquisitions have already been made.

There exist 51 electrical cranes with translatory action; one of 4,000 kilos, five of 1,500 kilos and the remainder of 5,000 kilos, and 26 steam winches of 6,000, 4,000 and 2,000 kilos, movable over port sidings of the normal gauge of 1.435 metres. The electric cranes run on special rail tracks laid outside the quays.

The port further disposes of one versatile Naphtha crane, two caterpillar gas-oil tractors, and a number of hand power winches and steam fixtures. There is also a floating crane with lifting capacity of 80 tons.

On the berthage quays there are three warehouses of three storeys, four of two storeys and five with single floor, all of material which permits the storage of 300,000 cu. m. of merchandise.

For river traffic there are 785 lineal metres of quay, which cover an area of 20,184 square metres, adding for coastwise navigation 800 metres of quay wall berthage and a superficies amounting to 17,000 square metres.

Other zones of the harbour possess 15 warehouses, which are served by the port railway system. In Dock No. 2 there is a capacious cold store.

The port contains a vast network of sidings connected with the railways of Uruguay, which extend to the interior of the Republic and to the east, west and south shores.

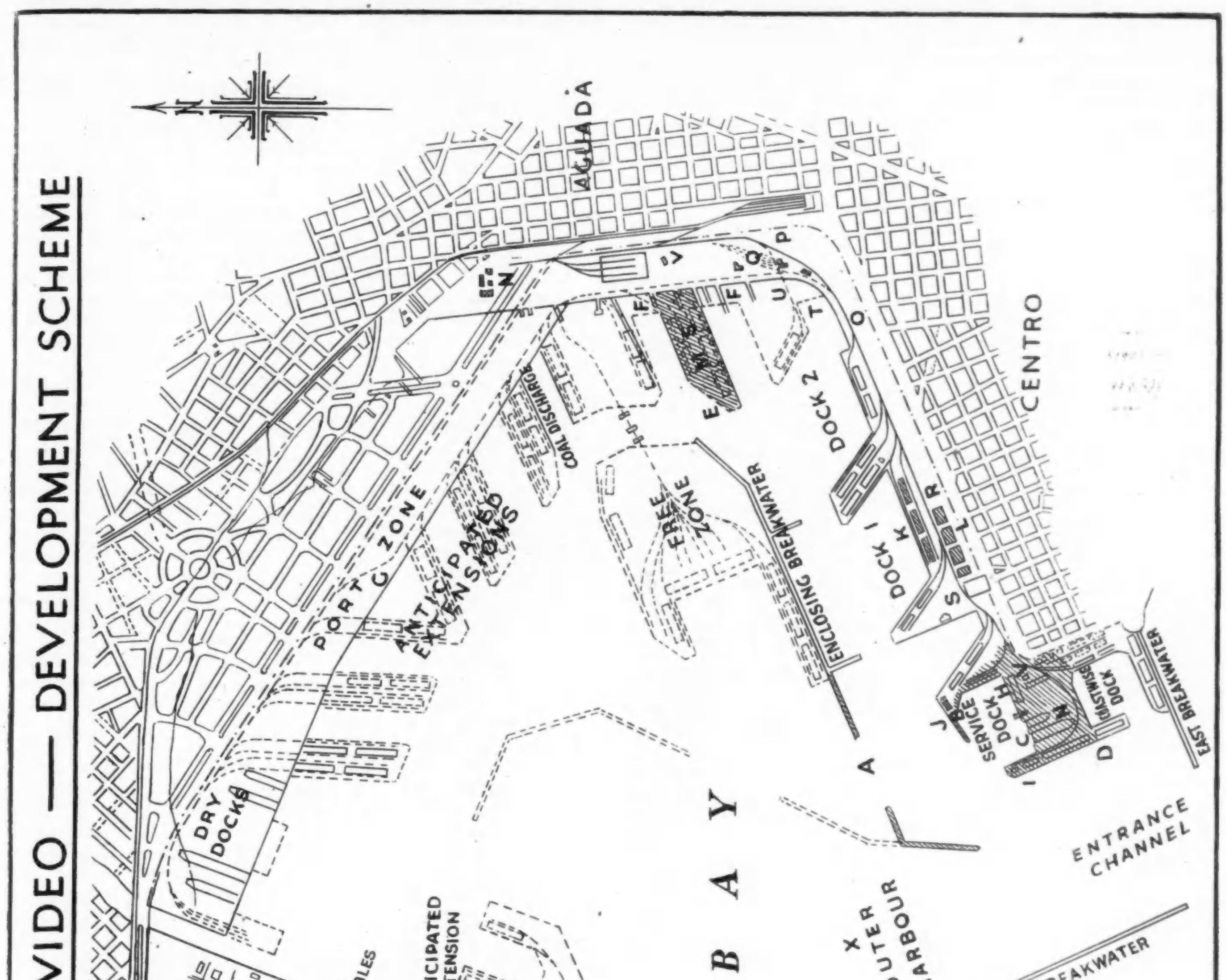
A district of the port is devoted to the service of hydroplanes, which maintain daily flights between Montevideo and Buenos Aires.

In the bay adjoining the harbour is situated the National Dry Dock, the dimensions of which are: total length, 137.16 metres; entrance width, 18.63 metres; breadth on floor, 14.10 metres; maximum depth at high water, 7.32 metres; maximum depth at low water, 4.27 metres.

The property of the National Port Administration also comprises a slipway and a floating dock. The Gas Company also possess a dry dock with the following dimensions: length, 83 metres; width, 15.25 metres; draught, 4 metres; with 4.25 to 4.50 metres depth at entrance.

Another slipway, private property, exists in El Cerro, adjacent to the harbour, being actually constructed for a private undertaking, a floating dock of reinforced concrete and a dry dock for vessels of large tonnage.

Recently there has been incorporated—for a private firm—in the


PORT OF MONTEVIDEO — DEVELOPMENT SCHEME
N
AGUADA
CENTRO
DOCK 2
DOCK 1
FREE ZONE
ENCLOSING BREAKWATER
COAL DISCHARGE
PORT ZONE
ANTICIPATED EXTENSIONS
DRY DOCKS
DOCK FOR INFLAMMABLES
ANTICIPATED EXTENSION
NAVAL BASE
CERRO
BAY
OUTER HARBOUR
ENTRANCE CHANNEL
WEST BREAKWATER
EAST BREAKWATER
SERVICE DOCK
COASTWISE DOCK
1st Stage of Development shown Hatched
Future Developments .. Dotted
Scale of Metres
0
1
2 K.

Port of Montevideo—continued

activities of the port, a floating dock of 15,000 tons capacity, in which the largest vessels frequenting the River Plate can be overhauled and repaired.

A numerous fleet of powerful tugs, plant and suitable appliances assure efficient service in assistance and salvage to overseas vessels which incur accidents in Uruguayan waters. In all these respects the Port of Montevideo proves its capacious and successful operation.

Transit Operations

The port renders itself particularly attractive to merchandise in transit for Paraguay, Bolivia, etc.

Moderate port tariffs and a regimen of immunity for goods in transit from the payment of dues during twelve months greatly encourages the traffic. There are offices which take charge of the collection and re-despatch of cargoes, for a small commission per ton.

The policy which has directed the authorities responsible for the administration and exploitation of the port has been that of offering speedy, efficient and cheap service.

Statement of New Works and Acquisition of Working Appliances.

		$
1.	Breakwater for the defence of the landing quay (A) ...	500,000
2.	Enlarged Western Breakwater, 400 metres (W) ...	1,000,000
3.	Dredging for the expansion of the Outer Harbour, 3,600,000 cu. metres (X)	1,500,000
4.	Sheds 3, 4 and 5, transformation (K)	2,500,000
5.	Warehouses, 2nd row (4 floors) (L)	2,500,000
6.	Warehouses on "D" Quay (M)	6,000,000
7.	Port Workshops (N)	1,000,000
8.	Service Sidings to docks (700 metres)	200,000
9.	Service Sidings to landing quay (500 metres)	150,000
10.	Cranes, 4 tons, and lifting appliances	500,000
11.	Wagons and locomotives	250,000
12.	Exchange Sidings for A and B Jetties (1,000 metres) (O)	300,000
13.	Central Station for ditto (1,500 metres) (P)	450,000
14.	Cranes and lifting appliances for Sheds 3, 4 and 5 ...	1,800,000
15.	Discharging Machines between 3, 4 and 5 Warehouses	1,800,000
16.	Wagons and locomotives	750,000
17.	Depôt for locomotives (1,000 sq. metres) (Q)	75,000
18.	Sidings for D Jetty (3,000 metres)	900,000
19.	Cranes and lifting appliances	2,000,000
20.	For reparation and increase of launches	700,000
21.	Enlargement of Slipway	300,000
22.	Workmen's canteen (R)	100,000
23.	Offices for sites (S)	50,000
24.	Expropriation of business firms	400,000
25.	Quay for hydroplanes (T)	100,000
26.	Adaptation of passenger station (U)	50,000
27.	Auxiliary locations (V)	60,000
28.	Investigation and dredging equipment	1,800,000

Correspondence

To the Editor of "The Dock and Harbour Authority."

Dear Sir.

War-time Engineering Problems

I read with interest the article on the above subject which appeared in your August number and was particularly struck with some of the author's comments on the Phoenix Breakwater Caissons.

The general tone of his remarks, however, rather tends to create the impression that he is speaking with authority based on special knowledge, but such is not the case, and from the nature of his criticisms it is obvious that Mr. Minikin, like many others around the fringe of the Mulberry project, fails utterly to appreciate the fundamental requirements of the whole undertaking.

It was not a question of building a nice peace-time breakwater, guaranteed to withstand every known, suspected, or imagined wave force plus a large additional factor of safety to cover the reputation of the designers. It was part of what was primarily a military operation and it was treated as such by the military staff engaged upon it.

Practical experience of a campaign soon produces realists—there is simply no room for others.

Six miles of breakwater which would last for three months was required in six months' time and this six months had to include the investigation and design—a normal twelve months' job on its own.

The mere fact that six miles (involving about half a million cubic yards of reinforced concrete) *were* produced in six months is for any engineer of practical experience, sufficient comment on the last paragraph of Mr. Minikin's article.

I will readily agree that, except perhaps for the flexible bridges, there was nothing specially remarkable about the engineering side of Mulberry Harbour other than the unsurpassed speed with which it was produced, but, it should be emphasised, the attainment of such a speed demanded perfect co-operation of a team of engineers who not only knew what to put in but who had the equally important qualification of knowing *what to leave out.*

Six miles of apparently ugly-looking caissons complete and set down on the Normandy beach, was perfection compared with what six miles of very elegant peacock-like structures would have been, if still in a half-finished state around the English coast on the appointed day.

But *were* the Phoenix caissons actually unwieldy at all, as Mr. Minikin asserts?

I know of course that various Admirals always referred to them as "unseamanlike objects" but then they said this as soon as they knew they were to be of concrete and produced by the Army instead of the Navy! Actually many of the very high naval critics were quite unable to imagine concrete floating at all.

An indication of the Naval mind can be discerned in the book by Com. K. Edwards, R.N.—"Operation Neptune"—when he seriously puts forward as the reason for the War Office being entrusted with the design of the Phoenix, the naively amusing statement that the War Office had cornered all concrete supplies!

The ideal practical shape for these caissons would have been perfectly rectangular box-like structures, although I can imagine Mr. Minikin might have demanded some graceful outward curve to the tops of the walls calculated to some mathematical formula of wave motions.

The only two deviations from the box-like shape were adopted by us precisely to make them less unwieldy. The failure by the Navy to provide anything like sufficient tugs for "Operation Overlord" made the cutting down of towing resistance of prime importance, hence the swim-ends, which were most undesirable in the breakwater itself. Then the fact that caissons would have to make a voyage of anything from 100 to 700 miles with a crew aboard was largely responsible for the adoption of side gangways.

Many of the large type of caissons were towed across the channel at 10 knots, which was a considerably faster speed than was attained by many of the blockships under their own power!

The average time taken to plant a caisson in its appointed position on the sea bed was $1\frac{1}{2}$ hours from its arrival within sight of the harbour. Was this unwieldiness?

The truth is that Phoenix were the most versatile large caissons ever built, and sinking and raising them became a commonplace event, some of them having been down and up at least 3 times before reaching their final destination. In pre-war days the design, construction, moving and sinking of even one 7,000 ton caisson would have been an event.

Mr. Minikin states that much valuable time was wasted in exploring forms of breakwater which he would immediately recognise as useless. Here again he seems to have no conception of the tempo of this engineering work of which he speaks so slightingly. The whole work of the N.P.L. Ship Department at Teddington had to be measured in hours and minutes, not months and weeks as Mr. Minikin seems to imply.

The most valuable and friendly work of Dr. Todd and his staff (assisted by model makers from the War Office) was not in leading, but in following and checking the work of the team.

Mr. Minikin's statement that "the original designs of Phoenix were found to be unstable" is another example of a little knowledge being a mischievious thing. It is quite wrong in its application. Out of six distinct types under construction it was found that the "A1" would have capsized during flooding and sinking before touching down if the operation was carried out in very deep water. The purpose of Dr. Todd's tests was to find out snags of this kind and the addition of a few very small brick baf-

Correspondence—continued

ie walls at the bottom as suggested by Dr. Todd himself easily remedied this fault.

Incidentally this particular defect existed in most of the blockships provided by the Navy and was unforeseen or was ignored, for during sinking they usually went over to about 45 degrees before touching down and it was only the extreme shallowness of the water where they were located which saved them from turning turtle.

I could enlarge at length on many other difficulties which had to be overcome without any pause in the tempo—lack of dry docks during construction which forced the contractors into making their on— all included in the six months!

The unexpected and complete failure of the Navy to provide any mooring facilities in the assembly areas for the finished caissons necessitated not only sinking them all on our own beaches but also raising them again at the rate of 8 or 10 per day, with improvised gear, to the acompaniment of much adverse criticism from the very people who had forced such a situation upon us.

Finally, one cannot help regretting that in his last paragraph, Mr. Minikin was so eulogistic in his reference to the "seamanship, courage and endeavour" which were required to tow a lot of perfectly towable gear across the English Channel in the wake of the invasion. The Navy undoubtedly did a good job of work here, but so far as the above quoted qualities are concerned, surely the palm should go to the fleet of minesweepers which acted as the very spearhead of the invasion.

Chief Engineer's Office,
Port of London Authority.
27th August 1947.

Yours faithfully,
W. J. Hodge,

Liverpool Observatory and Tidal Institute

Excerpts from Annual Report for 1946

In the Annual Report for 1946 of the Liverpool Observatory and Tidal Institute, a tribute is paid to Professor Proudman upon his resignation from the Directorship of the institution. His many duties in connection with the University, and his services to science in various other ways, were such that he felt unable to continue active responsibility for the Observatory and Tidal Institute, and he resigned from that responsibility as from December 31st, 1945. He retains his place on the Governing Committee, and continues his interest in the research work of the Tidal Institute, especially where the Institute and the Department of Oceanography can co-operate. He has been succeeded by Dr. A. T. Doodson.

Research

In the last report, issued in October, 1945, reference was made to a method of analysis of tidal data in the form of high and low water heights and times. The potential value of this method was such that the Hydrographic Department requested Dr. Doodson to prepare a version of this method for departmental use, and the opportunity was taken to develop the method so that it would serve to analyse tides which became occasionally diurnal in character or which were wholly diurnal. The original method had made use of series expansions which could not be used for the extreme conditions mentioned. Accordingly a completely new method of analysis was devised so that one plan could be followed for all types of tidal conditions. Tables were prepared to enable the diurnal and semi-diurnal tides each day to be obtained from the observed tides. In effect these tables reversed the fundamental tables of the Admiralty Method of prediction. Certain assumptions have to be made for the determination of the shallow-water tides and also for mean tide level when the tides are diurnal in character, but the difficulties encountered were successfully overcome.

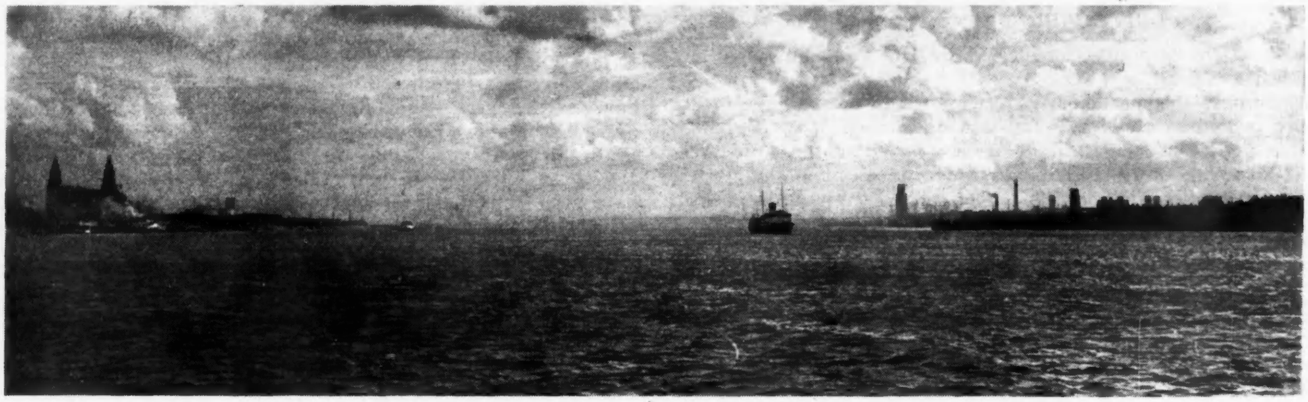
The researches into the storm surges in the Thames Estuary have been actively pursued by Mr. Corkan during the year and his report is nearly completed. This will give full details of the major storm surges, with an account of the meteorological situation, accompanied by charts, in each case. The progress of the surge along the coast is studied in relation to its generation and sustentation, whether by winds in the vicinity or in the North Sea. Formulæ have been devised which allow of the calculation of the storm surges from a knowledge of the meteorological conditions, and these formulæ are very successful. Many types of surges have been studied and the synthesis or prediction is usually of high accuracy. The probability of occurrence of disastrous surges has also been studied by Mr. Corkan, in continuation of the work done by Dr. Doodson after the disaster in the Thames in 1928. The report will be made to the London County Council and the Port of London Authority, who, along with other interested bodies, commissioned the Tidal Institute to carry out the investigation.

The research on turbulence in tidal currents, which was actively pursued before the war, has been recommenced in association with the Department of Oceanography in the University, under the general direction of Professor Proudman. The work done before the war involved the use of a motor-boat about 6 miles south of the Isle of Man, but so far no ship has been available for the continuation of that phase of the work. One of the greatest difficulties in work at sea is that of discriminating between the indications of the current-meter as due to turbulence or to the motion of the vessel, even when at anchor. The possibility of experiments from a stable platform was opened up by the existence of forts in Liverpool bay. These consist of open-work structures on piers, seven buildings being spaced out in the sea, and connected by high bridges from which operation could be conducted. By a suitable choice of position, observations of the incoming tide could be made without fear of disturbances by the iron work of the structures.

The current meter was placed in a strong framework constructed at the Observatory so that it could be anchored at the bottom and held by the cable at the top, so restricting the to-and-fro movement of the meter. Some observations were made by a party consisting of Mr. Corkan from the Institute, and Dr. Daniel, Mr. Bowden, and Mr. Atkins from the Department of Oceanography, for a few days in July. The results wereof such interest that a longer period was spent there, in somewhat better conditions of weather, in November, and on this occasion the variations of pressure at various depths were recorded as well as the variations of current. The pressures were measured by means of a Favé meter which had had its clockwork replaced by a small electric motor so geared to the plate of the recorder that the record was traced at a rate of about one inch per minute. Under the microscope an oscillation of 5 seconds period was on a very open scale. The current meter was run at a very fast rate of record of two inches per minute.

Both current and wave measurements were made at various depths below the surface. During a period of strong winds the fluctuations of pressure and of current due to the wave action were recorded. It is believed that this is the first time that quantitative observations of this kind have been obtained. The task of comparing the observed attenuation of amplitude with depth is rendered difficult by the presence of a band of periods, but present indications are that the observations will not differ greatly from the theoretical values. The analytical work is being carried out by Mr. Bowden, who is also studying the "true" turbulence.

Continuous interest has been shown in the problems of the proper use of tide models for the simulation of tides in estuaries. The report drawn up last year for the Port of Bristol Authority was placed by them before the authorities investigating the possibility of reviving the scheme to obtain electrical power from tides in the Bristol Channel, and this no doubt contributed to the decision that if the scheme were to be further considered a new model should be constructed. Such models of necessity have exaggerated vertical scales and this seriously affects their validity when the tides are large. There is a growing interest in the country with regard to the practical problems of hydraulics and as these are often of tidal interest the Institute will give increasing attention to such problems. Dr. Doodson has been requested to serve on the newly-constituted Hydraulics Research Board which is to advise the Department of Scientific and Industrial Research on the problems to be studied in connection with waterways, including harbours and estuaries, and with coastal erosion.



The River Mersey looking South, showing the Ferry Track. Taken at a time when very little shipping was moving. One Wallasey Ferry Steamer moored at Seacombe Stage (on the right)—one at Liverpool—with a further one bound North for New Brighton (on the left).

The Installation of Radar for Wallasey Ferries

By L. D. PRICE, A.M. Inst. T.,
General Manager, Wallasey Corporation Ferries

BY now many people are familiar with the basic principles of Radar and how it functions in aerial and marine navigation; hence I do not propose to dilate upon that side but rather to examine its potentiality in relation to World trade in general and to that of Britain's in particular and thus make use of the extensive scientific knowledge and practical engineering skill possessed by Scientists and Radar Engineers to the best advantage and to set out in some detail the problems antecedent to the installation of Radar at Wallasey Ferries and how they were overcome.

The great and sustained productive effort needed from our countrymen today to surmount (as surely we will) the crisis which now faces us, demands primarily efficiency in directing it. As the transport of man and goods forms an integral part and has a great bearing upon the productive effort, it is due from the Transport industry to give of its best. I am one of those who believe that the rank and file will pull their full weight if given a right lead and set a good example by those holding executive and administrative positions within the industry, thus inspiring confidence in Management.

Fog has always been the great obstacle of all forms of transport and if its effect can be materially minimised then indeed the transport industry will have accomplished something which will enable it to help forward the productive drive and hasten the economic recovery of our country, much weakened by two wars. That Radar, properly applied, can achieve this in many cases I feel confident.

With the above object in view and appreciating the paramount necessity for ensuring the safety of the travelling public, the Wallasey Corporation Ferries, recently installed this device.

This Undertaking transports across the River Mersey annually approximately 20,000,000 passengers. The majority of these are Contractors (or season ticket holders), business-men or artisans mostly domiciled in Wallasey and working in Liverpool, who use the Seacombe/Liverpool Service. Throughout the twenty-four hours a service is maintained here in all weathers. It varies during the day from intervals of ten minutes at mornings, mid-day and evening peak periods, to hourly intervals between 2 and 5 a.m. When one considers that during the densest fog, day or night, this service has not closed, despite a tide at springs running at six knots, it can be understood readily that the Masters of the Steamers who have this proud record of navigating safely vessels carrying up to 2,200 passengers without loss of life for over sixty years, would receive with dubiety questionable proposals for speeding up the service during the prevalence of fog in the hope of avoiding inordinate delays which sometimes have occurred, especially when, by the very nature of things, these men do not often have the opportunity of seeing for themselves at first hand the marvellous achievements of modern science.

What were the problems presented in seeking to use Radar for this important cross-river service? First, I had to be convinced that the fitting of Radar would increase the efficiency of the Ferry Service and also further the safety of the travelling public by reason of adding to those measures already in existence, and not be merely the installation of a pleasing, but expensive toy. I entered into enquiries with an open mind, knowing exactly what the minimum requirements were, but realising that as yet equipment was imperfect and untried for such a special purpose.

Having satisfied myself with regard to this—it took two years of very full study and enquiry to do so—two further steps were necessary—

(a) To convince the Masters of the Steamers that they could be provided with a very real aid to navigation.

(b) To persuade Manufacturers to assist me in trials and experiments, with the prior knowledge that in all probability I would require modifications to their ordinary equipment to meet our special needs.

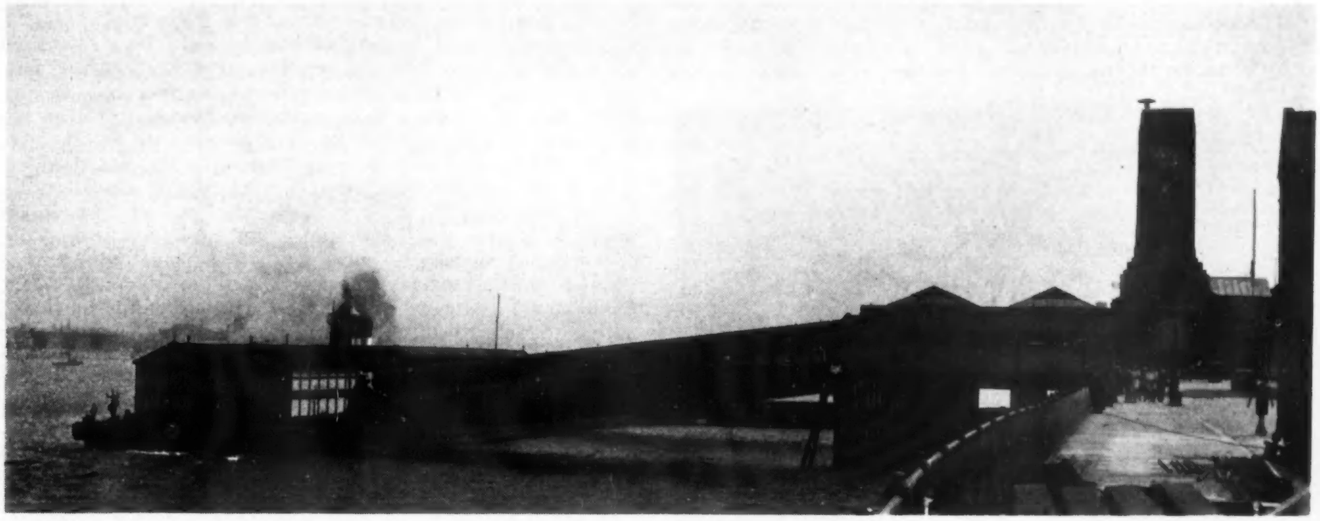
I suggest that the problem of dealing with (a) was largely psychological, and (b) a somewhat unusual course on the part of a prospective purchaser.

The problem of (a) was solved by means of lectures followed by practical demonstrations, in which it was shown clearly that the object of the Management was to provide them with accurate, up-to-the-moment information regarding Vessels anchored or moored in the proximity of the Ferry track, also their own relative positions to each other and to the landing stages, by the best available scientific means than in any way encroach upon their duties and responsibilities as Master.

The second step (b) to persuade Manufacturers who have an excellent article on the market that they should alter and modify this considerably to meet our special requirements, was not easy but it was eventually accomplished and I must pay tribute to Messrs. Cossor Marine Radar. Ltd., that once agreement was reached, every possible form of co-operation was given by them.

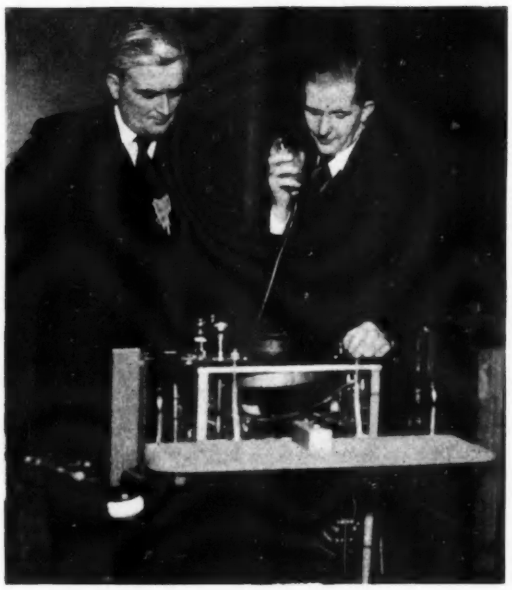
At an early stage during the two years mentioned earlier I had decided that the Radar equipment should be installed ashore and not be fitted on the Steamers. The principle reasons for this were that in fog, when running across the tide, which could be six

Installation of Radar for Wallasey Ferties—continued



The Scanner on the Clock Tower at Seacombe—Ferry Vestibule, Bridges and Landing Stage with one Ferry Steamer berthed alongside.

knots, with vessels anchored in or about the Ferry track and perhaps a few other craft also in the vicinity moving, the Master and the Mate (who steers the Vessel) could not possibly spare time to study Radar screens. Secondly, even though either of them had such time, or alternatively, if an additional hand were put on board, the minimum effective range of Radar at present is approximately 40/50 yards, and notwithstanding that the passage across the River can be very difficult and impose a great strain, it is insignificant compared with final approach to a landing stage,



The Author (left) watching the Senior Radar Operator giving Radar information to Ferry Steamers on the Standard Cossor Marine Radar, which is at present installed.

particularly on the Seacombe side. Thirdly, as all the Fleet in rota pass through their Surveys during the six months of the Winter—i.e. during the time when fog is prevalent—it would entail fitting Radar to each Vessel, or alternatively removing the equipment from the Vessels in Dock and refitting it on the Vessels on service. Messrs. Cossor's Scientists and Engineers agreed that this principle, upon which I was determined, was a correct one.

A suitable site had to be found for the Scanner. It was eventually determined partially by the fact that the minimum range claimed for the Cossor Standard Marine Radar Set which we used for the trials, is 50 yards and thus the Scanner had of necessity to be set back from the stage by at least that distance so as to give a definition of the stage on the Cathode Ray Tube Indicator. Another difficulty encountered was that the Seacombe landing stage is screened from the shore by its own buildings. The Clock Tower, 90-ft. above ground level and standing back from the front of the stage at a horizontal distance of 317-ft., was chosen. As can be readily seen from the photograph this position has several advantages over others in the vicinity.

The present equipment comprises a Transmitter operating on 9,475 Mc/s per second, output power 22 K.W. peak, pulse width .2 micro seconds, repetition 2,000 pulses per second.

Power is transmitted to the aerial by a 44-ft. run of American Standard Wave Guide, which by virtue of the ample space available on shore, is entirely straight. This feature is probably responsible for the good minimum range performance of this particular installation, which is appoximately 45 yards.

Aerial beam width is $\pm$ 1° and speed of rotation 50 r.p.m.

The band width of the receiver is $\pm$ 4 Mc/s per second at 3 d. b.

The Indicator utilises a special 9-in. Cathode Ray Tube operating at a voltage of 8 K.V. The Screen material is a special fluoride mixture having the property of long afterglow and almost total absence of primary flash. The displayed ranges are .8, 1.5 and 3.5 miles. With this equipment a minimum range of 50 yards is obtained. Separation between two objects differing in bearing by more than 2° or in range by more than 40 yards, is obtained.

The run between the main equipment and Indicator is 50-ft.

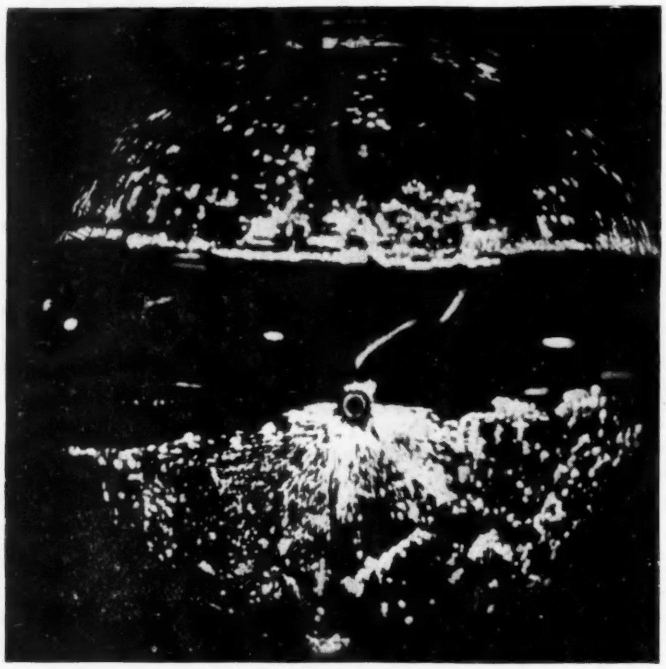
The entire equipment operates from 180 volt 500 cycle supply obtained from 220 volt D.C. supply by means of a Convertor.

Trials without contact with the Steamers took place over a period lasting three or four weeks, and the results were surprisingly good, the picture obtained from the Cathode Ray Tube Indicator on the 1.2 miles range having a very clear dfinition. Minimum range was found to be about five yards better than claimed for the set. It was found from experience however, as I had anticipated, that the presentation on the standard set did not provide a sufficiently large scale for the close navigation required on this Ferry Service.

When a Merchant Ship fitted with Radar is making a landfall such as a headland, a light vessel, etc., to ensure safety a short study of the Indicator together with a comparison with the ap-

Installation of Radar for Wallasey Ferries—continued

propriate chart can be made, followed by a further check perhaps fifteen minutes or half an hour later, whereas with our shore-based installation, Operators will need to watched the Indicator constantly during the prevalence of fog for perhaps three or four



The above is a photograph of the Cathode Ray Tube Indicator working on a range of 1.2, loaned by courtesy of the Liverpool "Echo," which was taken by one of their photographers after the official trials. The prominent features on both sides of the River are remarkably clear, but unfortunately the exposure has occupied some minutes and therefore positioning of the moving steamers is shown over this period, and hence they appear greatly elongated and show the track of the steamer much too brightly. The splendid definition, however, is clearly illustrated by a group of small yachts and rowing boats anchored to the north of Seacombe, on the Cheshire side of the River.

days without a break, in order to give reliable and accurate information to the Masters. It was found that longer than forty-five minutes produces mental strain in those keeping watch under these conditions, also that a good Operator *with local knowledge* can provide more detailed information from the picture than can the most experienced Operator without local knowledge.

The Operators have been chosen from amongst the Junior Masters or Senior Mates, who themselves have had the responsibility of navigating the Steamers across the River and who know exactly the type of information required by the Master during fog—men upon whom the Masters can place reliance. The keeness of all concerned to obtain the best practical use of the installation augurs well for its successful operation.

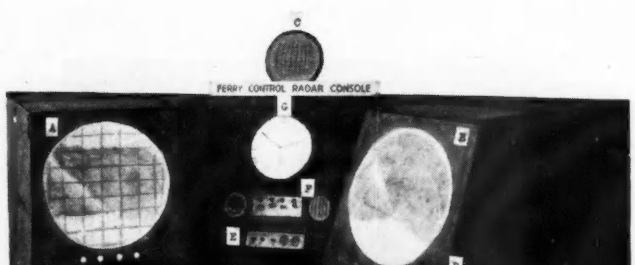
After the above three or four weeks, Radio Telephones of the Marconi Mobile V.H.F. Transmitting/Receiving Type H.16, were fitted, one in the Radar Room and one on each of the two Steamers maintaining the Liverpool/Seacombe Service. These R/T's can be adjusted to work on any frequency between 78/100 Mc/s. They are powered by 12 volt batteries and consume 15 amps. when on "Transmit" and 6.7 when on "Standby". Reception was excellent throughout the trials but the ranges over which the Sets were working never exceeded a mile. In clear weather information was provided continuously to the Masters of these Vessels by a Loud Speaker fitted to the Bridge. The information was transmitted from the Radar Room in short and concise messages and the information was checked visually by the Master on the Bridge; in order to assist the Operator, the correctness or otherwise of such information was reported to the Radar Room. Under Service conditions it is intended to work the telephones as much as possible in one direction, i.e. from the Radar Room to the Vessel and so avoid "chatting". Just prior to sailing the Master or Mate will call up and ask for disposition of Ships and at fixed intervals let the Radar Room know that reception is satisfactory or otherwise. Other than that, as already stated, the Telephones will be worked on the basis of—the Master needs the information—the Radar Room has it.

The Senior Operator believes that with the Standard equipment which we have installed at present he can estimate distances within an accuracy of 50-ft. I believe myself that 75/100-ft. would be a more cautious estimate but even this figure will surprise many people.

Later, official trials were held when the Mayor of Wallasey (Alderman B. G. King, J.P.), the Chairman of the Ferries Committee (Alderman F. S. Atkin), Representatives of the Technical, Daily and Local Press and Representatives of Messrs. Cossor Marine Radar, Ltd., and Marconi, Ltd., were present. The Senior Operator above referred to, with his local knowledge and a little intelligent anticipation—such as an experienced Master or Pilot must exercise at all times—estimated distances within 10-ft., but with regard to this performance I would emphasize the assistance given by local knowledge and intelligent anticipation—which after all is not infallible. However, the results were extremely gratifying and a complete vindication of the theories which I had formed earlier.

A comprehensive installation to my specification will be proceeded with. In the meantime Messrs. Cossor Radar, Ltd., will instal almost immediately their latest Standard Marine Set with small modifications and within twelve months from that date it is hoped that the specially designed Set will be ready for installation.

The photograph of the Console is of a full scale model as "mocked up" in our Joiners' Shop and gives a general idea of the



Proposed lay-out of Console, showing:—

(a) Indicator Screen 1.2 miles with Grid for reference position superimposed; (b) Indicator Screen, .4 miles with approach bearing lines and distance circles superimposed; (c) R/T Loud Speaker; (d) R/T Microphone; (e) R/T Control Panel; (f) Internal Communication—Dictograph System; (g) Clock, large "Second" Hand; (h) Ready Access Panel to Indicator Unit; (i) Ready Access Panels, front; (j) Ready Access Panel to R/T equipment.

proposed layout. It should be made clear that in designing this Console little regard has been given to the question of space, which is so important on a Vessel; rather, everything has been subordinated to a good presentation so that Operators can have the best possible chance of concentration with a minimum of strain and

Installation of Radar for Wallasey Ferries—continued

fatigue. By this means it is expected to get results which will more than justify the additional outlay involved. I would make it clear, however, that although I have designed the general layout and will specify the performance required, the details of design are being left entirely to Messrs. Cossor's Technical Experts.

The final equipment will operate on 9,475 Mc/s per second with a pulse width of .1 micro seconds. The other properties of the Transmitter will be unchanged.

The Receiver will have a band width $\pm$ 10 Mc/s per second at 3 d.b.

The Indicating Console will utilise two 15-in. Tubes operating at 10 K.V. The displayed ranges will be .4 miles, permanently displayed on one tube, 1.2 or 3.5 on the second tube.

With this equipment separation will be obtained between two objects differing in range by 20 yards. It is anticipated that the minimum range will be reduced to some 30 yards.

The entire equipment operates from 180 volt 500 cycles supply, obtained from 220 volt D.C. supply by means of a Convertor.

From the photograph the two Cathode Ray Tube Indicators will be specially noted, one for close approach work to the Seacombe landing, working on a range of 0.4 miles, and the other which will be normally used on a range of 1.2 miles covering the whole area of the Ferry track with facilities to switch over to a range of 3.6 miles covering our New Brighton Ferry Service and the area Dingle Oil Jetty, where we bunker our Vessels. It is anticipated that estimating distances will be greatly facilitated as compared with the Standard Set.

In the meantime certain Members of my Staff, already very good Operators, will proceed to the Cossor Factory and Laboratory for further instruction, also to obtain elementary training in maintenance work.

I believe that the specially designed equipment which it is hoped will be ready here for operating in the Winter of 1948/9, will prove to be the prototype perhaps with minor modifications for special cases, of Radar Sets for Harbour control in medium and small harbours, also for Ferry Services throughout the World. Needless to say a tremendous interest has already been shown in our installation and on behalf of my Committee I shall be happy to welcome those responsible for Harbour administration, and Representatives of Shipping Companies who wish to see either the standard set in operation or, later, the special set when installed.

Doubtless, water borne transport was the first form of transport used by early man. What startling advances it has made since those pre-historic days!

In conclusion, it seems but fit and proper in view of Sir Oliver Lodge's work on electro magnetic waves whilst Professor of Physics at Liverpool University (then University College) that the first commercial shore-based installation for marine navigation should be on Merseyside in the Port of Liverpool, to assist the Wallasey Ferries still further in the safe navigation of their Vessels while crossing the River. Another and more impressive monument will be erected when the super Radar Station now being fabricated for the Mersey Docks and Harbour Board, is completed and in operation.

Lighthouses on the Coast of Sarawak

Rehabilitation Programme in Hand

Much discontent amongst masters of vessels plying between the ports of Borneo and Singapore, caused by the smashing and looting of lighthouse apparatus and consequent extinguishing of the lights, has made the rehabilitation of these lights a most important matter. An engineer from Messrs. Chance Bros., Ltd., London, recently visited the Far East and worked out details for all lighthouses in Sarawak, and orders have now been placed for the lights of greatest importance based on the engineer's specification.

The adoption of Chances' semi-automatic electric lighthouse system in Sarawak shows that the native labour problem no longer provides difficulties in maintaining electrical equipment, due to the fact that long experience has triumphed in providing an all-electric lighthouse which can be kept and maintained by relatively unskilled labour. The new apparatus is as follows:

Tanjong Baram Lighthouse

Apparatus embodying petroleum vapour illuminant was supplied in comparatively recent years and it has now been decided to electrify the existing apparatus by installing an automatic lamp-changer in the existing optical apparatus so that upon one lamp failing a stand-by lamp is introduced instantly and automatically. The clockwork machinery which rotates the existing apparatus is to be the stand-by means of rotation under the new system since an electric motor will drive the optical apparatus under normal circumstances.

Triplicate engine generator sets, any one of which may be selected to supply current for operating the optical apparatus, will be started and stopped by push-button control and if the operating set develops a fault continuous alarm is given until the keeper starts a second set. The third set is held in reserve in case a breakdown develops whilst one of the sets is undergoing periodical overhaul.

A special fault detector for each engine generator set shows the servicing engineer when on periodical visitation where the fault is to be located so as to reduce the time taken to rectify the fault to a minimum.

The candle-power of the triple flashing light when electrified will be approximately 450,000.

Tanjong Sirik Lighthouse

Completely new apparatus is being supplied for this lighthouse and the optical apparatus will exhibit a single flashing character every 10 seconds. Each flash will be of approximately 500,000 candle-power. A lamp-changer caters for possible failure of the lamp in service by replacing it automatically. Should the motor rotating the optical apparatus develop a fault a second motor is brought into service automatically.

The electrical generating plant is to be identical with that described for Tanjong Baram.

Tanjong Po Lighthouse

The lense apparatus at another lighthouse is being repaired by Chance Brothers for use here, and will be mounted upon a new rotating mechanism similar to that described for Tanjong Sirik lighthouse together with an automatic lamp-changer. The candle-power of the apparatus will be well over half-a-million and the engine generator and control equipment is to be identical with that described for Tanjong Baram lighthouse.

Jerijeh Lighthouse

New apparatus similar to Tanjong Sirik lighthouse complete with lamp-changer, triplicate engine generator plant and lantern is being supplied for Jerijeh lighthouse, the power of which will be approximately 250,000 candle-power.

Tanjong Datu Lighthouse

Automatic, unattended acetylene equipment is being supplied for temporary use at Sirik lighthouse pending delivery of the main permanent apparatus, when the temporary equipment will be fitted at Datu lighthouse. This will be of 500 mm. calibre with sufficient gas storage for giving unattended operation for approximately seven months.

Port of Liverpool Trade Returns.

Whilst the July figure of 145 ships completing discharge of cargoes at Liverpool is two less than the figure for June, the number of ships carrying export cargoes increased from 79 to 106. The quantity of foreign cargoes discharged at the port in July amounted to 711,366 tons as against 680,323 tons in June, and outward cargoes totalled 238,893 tons as against the June figure of 175,015 tons. The quantity of bulk petrol and fuel oil imported, however, is only a little more than half the June figure, 44,939 tons as against 84,015 tons during the previous month.

Notes of the Month

New Russian Canal.

A report from Moscow states that a new canal is to be constructed linking the River Kama with the River Petchora, to provide an outlet for ships into the Barents Sea.

New North German Canal.

Plans to complete a 70-mile canal link between the River Elbe and Dömitz and the Baltic Sea port of Wismar are reported from Germany. This would presumably make use of Lake Schwerin.

Radiotelephony for Clyde Steamers.

All the vessels of the Clyde pleasure fleet owned by the L.M.S. have now been fitted with radio telephones by means of which the captains are able to keep in continuous communication with the head office at Gourock.

Appointment of Docks Engineer.

The L.N.E.R. announce that Mr. W. Mackenzie, Assistant Engineer for Docks, has been appointed Chief Engineer for Docks (North Eastern and Great Central Sections) in succession to Mr. A. Tulip, who retired from the service at the end of last month.

Greek Ports Reconstruction Programme.

Mr. Dwight Griswold, the leader of the United States Aid Mission, announced in Athens that a third contract between Greece and the United States, dealing with the reconstruction of Greek ports, has been signed. The previous contracts were for the reconstruction of railways and roads. A fourth contract, for the reconstruction of the Corinth Canal was to be signed later.

Improvements at the Port of Seville.

The Spanish Government has announced it will undertake the improvement of the Port of Seville and the channel of the Guadalquivir River. The work will include construction of a canal to divert part of the river's flow in order to prevent erosion of the port in seasons of heavy rains, and improvements in handling and storage facilities to make the port capable of handling vessels up to 15,000 n.r. tons.

Extensions at the Port of Kolding.

The Jutland Port of Kolding is planning considerable extensions. The scheme includes the lengthening of the north quay by 450-ft. and the construction of a new quay with a length of 520-ft. and a depth of 20-ft., together with a breakwater jetty for tankers. The extensions are estimated to cost 3,600,000 kr. and the work will take at least three years to complete.

Radio Telephone Installation at Swansea.

The Great Western Railway Company have installed at the King's Dock entrance, Swansea, a Marconi radio telephone which will permit two-way communication with the pilot cutter "Roger Beck," similarly equipped by the Swansea Pilotage Authority. The new arrangement will be of considerable advantage in connection with the safe and speedy handling of shipping at Swansea Docks, as the dockmaster's staff will be in direct touch with the pilot cutter during tide time when the latter is on stations in the Mumbles roadstead and when visibility is limited owing to fog.

Campbeltown Harbour Repairs.

To meet the heavy cost of repairing the harbour at Campbeltown, the Town Council is to apply to the Fisheries Division of the Scottish Home Department for a grant. Campbeltown is one of the principal fishing ports on the West Coast of Scotland and although well known as a herring port is fast becoming one of the most popular seine-net fishing ports in Scotland, being extensively used by fishing fleets from the Clyde, North-East Scotland, the Isle of Man, and Northern Ireland. The question of establishing a fish-market at the quay is to come before the Harbour Committee of the Town Council as part of the Council's local industrial scheme.

Port Talbot Improvement Scheme.

To cope with the increased iron ore passing through the Port Talbot Docks the Great Western Railway Company is to lengthen its main discharging quay and provide five hydraulic pumps for supplying power on the quayside as well as impounding pumps with a capacity of 66,000 gallons a minute for maintaining the water level in the dock.

Garston Dock Official's Retirement.

Mr. John K. Wardle, assistant superintendent at Garston Docks, has retired owing to ill-health, after over 42 years' service with the L.M.S. and the former L. & N.W. Railway Company. Mr. Wardle joined the service at Garston Docks in February, 1905, and was transferred to the Euston H.Q.'s offices in 1923. In July, 1928, he was appointed to Barrow-in-Furness, from where he returned to Garston Docks in May, 1939, to take up the position of assistant superintendent.

Dar-Es-Salaam Dockers' Wages Increased.

African dockers received wage increases, some up to 40 per cent., under the award made by the arbitration tribunal which was appointed after the recent labour dispute which led to widespread strikes in Central Tanganyika. The tribunal itself was unable to reach agreement, and the award was made by the neutral chairman. The Government is reported to be considering the position of African labour (including railway workers) in relation to the new wage levels of the dockers.

Modernisation of German Baltic Ports.

The German ports of Wismar, Warnemünde, Rostock and Stralsund, on the Baltic, are to be modernised in the near future. The war meant a serious break in the work of the ports, but the time was used to prepare plans for far-reaching improvements. A dredging programme will increase the depth of water to 23-ft., storage facilities will be reconstructed and additional cranes installed. The monthly capacity of the ports is reported as follows: Wismar 100,000 tons, Rostock 80,000 tons and Stralsund 40,000 tons. Warnemünde is used chiefly for passenger traffic.

Buoyage System in France.

The French Ministry of Public Works and Transport has issued new regulations concerning the system of buoyage employed on the coasts of France and Algeria. In general, buoys on the port side of a fairway are of the cylindrical or spar type, with red and white markings, and buoys on the starboard side are of the conical or spar type, with black and white markings. To mark dangers to navigation, markings (with the danger point at centre) are black and white, with white lights, in the two quadrants S.W. to N.W. and N.W. to N.E., and red and white, with red lights, in the two quadrants N.E. to S.E. and S.E. to S.W. To mark wrecks, green buoys and lights are used, and yellow is the colour employed to mark quarantine anchorages.

Traffic at South African Ports.

An analysis of the Union of South Africa's harbour and shipping statistics for the year ended March 31st, 1947, shows that although fewer ships called at Union ports than in the pre-war period 1937-38, more cargo was landed. In 1937-38 a total of 11,420 ships with a gross registered tonnage of 39,754,425 called at Union ports. In 1945-46 the corresponding figures were 4,342 and 14,351,970, and in 1946-47, 6,666 and 23,923,075. They landed respectively 5,740,585, 3,691,564 and 6,171,325 tons of cargo. The volume of cargo shipped in 1937-38 totalled 5,539,343 tons, 4,254,631 tons in 1945-46, and 4,290,471 tons in 1946-47. Coal shipped and for bunkers shows an increase over 1937-38, but a decrease on last year. The figures are 1,781,779 tons in 1937-38, 2,112,233 tons in 1945-46 and 1,984,975 tons this year.

PORT OPERATION

Part Ten of a Series of articles by A. H. J. BOWN, M.Inst.T., A.C.I.S.
and Lt.-Col. C. A. DOVE, M.B.E., M.Inst.T.

(Continued from page 122)

Part 4 (C) : Cargo Handling

Cargo-Handling Gear

Cargo-handling gear may be described as the apparatus required by ship or shore workers for "making up" (preparing) or assisting in making up cargo sets, for lifting by means of ship's gear, cranes or other appliances with a similar purpose.

It is made, according to the purpose for which it is required, from cordage, steel wire rope, chain, timber, iron and steel.

Before proceeding to discuss the various types of gear and their uses, it is well to note that both cordage and steel wire ropes are measured by their circumference, i.e., a 2½-in. manilla rope means it is 2½-in. in circumference, but chain is described by its diameter. In describing rope, however, the word circumference should be used as practice is not uniform. Cordage, which is usually made of hemp, manilla or coir, whose relative strengths are in the order named, is normally supplied in coils of 120 fathoms. Steel wire rope is supplied in coils of 100 fathoms.

Rope ends are joined together by splicing them into one another. The effect of splicing ropes is to reduce their strength by about 25%.

Shackles

A shackle is a U or similar shaped piece of gear made of metal which is joined at its open end by means of a loose pin to form a link. It is used for joining different pieces of cargo-handling gear together and for providing the union between lifting gear, i.e., ship's gear or cranes and cargo-handling gear. A shackle if often used in preference to a cargo hook, particularly for heavy lifts and quick-release gear, because of the additional safety provided by the fact that it completely encloses the connecting link or ring of the cargo-handling gear to which it is united. Cargo blocks are often made with shackles instead of hooks, but these shackles are, of course, sealed by the blocks of which they are part.

Snatch Blocks

Snatch blocks are loose blocks used for leading wire or ropes round corners and obstructions, to prevent the wires or ropes being chafed by contact with the obstructions and the obstructions being scored by the wires or ropes. If correctly positioned, they possess the further merit of allowing a direct pull to be made on the cargo to be moved.

They are fitted at one end with a swivel hook or ring. The other end is free from any such attaching device. One side of the strap is designed so that it is hinged near the head of the block, in such a way that when the hinge is open a wire or rope may be placed over the sheave, without reeving the whole length through the block. When the rope or wire is on the sheave, the hinged part of the strap can be clamped back into position. This arrangement allows snatch blocks to be fitted very easily and quickly to any part of the running rope or wire.

They are particularly valuable in the holds of ships for manœuvring cargo into and out of the wings, from behind stanchions and other places which are difficult of access. They should be used to prevent the all too common malpractice of allowing runners and crane wires to chafe against ships' coamings when cargo is being "dragged out."

Hand Hooks

The hand hook is a small hook carried by dock workers for assisting them in manœuvring packages into position. Providing it is skilfully used it can be a valuable aid to speeding up work. If carelessly used, however, it can be responsible for serious damage to packages. It should not be used on packages which are easily pierced, on closely woven bags or in fact on any bags fitted with adequate lugs.

Pinch Bars

The pinch bar is a long crowbar used for moving heavy packages by hand by leverage.

Rollers

When cranes and other mechanical lifting aids are not available, rollers made from hard wood or metal may be used in conjunction with pinch bars for moving heavy packages.

Sling

The sling, sometimes known as the "strop," is probably the commonest form of cargo-handling gear. It consists of a length of rope the two ends of which have been spliced to make it into an endless belt. The sling is used by laying it in a narrow loop in the hold or on the quay and stacking the cargo on top of it nearer to one end than the other. The long end of the sling is then passed through the short end and looped on to the cargo hook. When the hook takes the weight, the sling automatically tightens and binds the set. In order to ensure that the bight of the sling will not slip after the set is clear of the ground, the smaller end should be beaten with a piece of timber, as far down the longer end as it will go without damaging the set.

Slings may be made with cordage or S.W.R.

The effective length of the sling should be about 3 to 4 fathoms (1 fathom=6-ft.), i.e., cut from lengths of from 6 to 8 fathoms joined at the ends by a short splice. The size of the sling depends upon the cargo to be worked. Slings are valuable for handling bag cargoes, but should not be used on packages which are readily crushed or torn or whose contents could be easily damaged by bruising, e.g., potatoes.

Snotter

The snotter, or snorter, is a length of cordage or S.W.R. with an eye spliced in each end. It is used in very much the same way as the sling, by passing one eye through the other and placing it on the cargo hook. It is used for strong packages which are not likely to sag at the ends when the lift is made.

Canvas Sling

To protect certain bagged cargoes, such as bags of potatoes, which would be damaged by the pressure of ordinary slings, slings made to enclose a length of canvas with a long loop of rope at one end and a short one at the other, are used in the same way as ordinary slings or snotters. A similar piece of gear to this, but slightly smaller, is used for slinging live cattle.

Chain Sling

A chain sling is made of a length of chain with a hook at one end and a ring at the other. It is used for handling long, heavy, slender cargoes, such as girders, rails, baulks of timber, etc., which are longer than the hatch through which they have to pass and therefore require to be tilted before they can be loaded into or discharged from the hold. Care must be exercised in using this gear to see that the chain at the hook end is taken twice round the set, i.e., a "complete round turn" must be made. The round turn is placed slightly to one side of the point of balance to ensure that the set tilts when the weight is taken. The ring of the sling is placed on the cargo hook of the quay crane or ship's derrick which is to make the lift. To minimise the possibility of the set slipping when it is in the air, a piece of timber on which the chain can bite should be inserted between the set and the chain.

Port Operation—continued

For handling lengths of rail, slings are sometimes made with an elliptical link at each end in place of a hook and ring, which are so shaped that they can be reeved through each other.

Chain Legs (Pairs)

A "chain legs" or double chain sling is two lengths of chain attached to one ring with a hook at each free end. This gear is used for similar cargo to single chain slings when a straight lift is to be made, i.e., when it is not necessary to tilt the set. Accordingly, when the set is made up, the legs are placed equi-distant from the point of balance. Wood should also be placed between the gear and the set. When using legs the student should remember that the safe working load of the gear decreases as the distance between the legs is increased.

Chain Fours

A chain four consists of two double chain slings attached to one ring with a hook at each free end of chain. This gear is mainly used for lifting cargo trays or cargo nets. Before using chain or any other form of fours, the operator must be sure that the four legs are of equal length to ensure (1) that the weight to be lifted is evenly distributed and (2) that the set will not tilt when hoisted.

Cordage or Steel Wire Rope Legs and Fours

Legs and fours can also be made with cordage or steel wire rope.

Can Hooks (Barrel Hooks)

These are broad hooks (see diagram) used in conjunction with an endless length of chain for hoisting barrels or drums. Two hooks and one length of chain are used for each barrel or drum. Usually four sets of can hooks can be used at a time on one cargo hook. This number can be doubled by using a type of spreader, with a hook at each end for the slings and a ring in the centre for attaching the spreader to the cargo hook of the derrick or quay crane making the lift. This form of spreader is sometimes known as a "yoke" or "whipple tree."

A development of this gear known as the "chandelier," has been designed to lift four sets at a time. It takes the appearance of four spokes of a wheel, with a hook at the end of each spoke to which a set can be slung and a ring at the hub for attaching the chandelier to the cargo hook or shackle of the quay crane or ship's derrick making the lift.

Can hooks should not be used unless the barrels or drums have fairly wide chimes and the operator is satisfied that they are strong enough to stand the pressure exerted when the sling takes the strain.

Dog Hooks (Case Hooks)

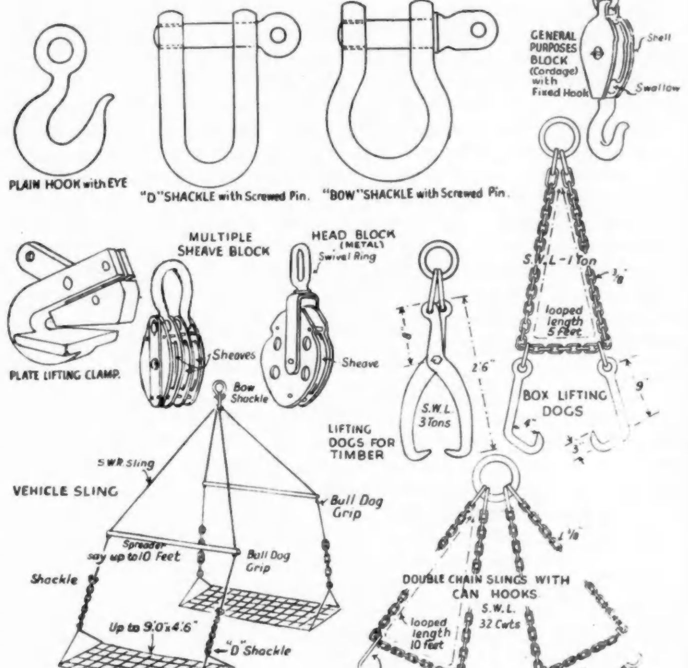
Dog hooks are fitted to an endless length of chain in the same way as can hooks. The dogs are placed on each side of the package and its spikes are pressed into the sides before the weight is taken. As soon as this happens, the sling tightens and the dogs automatically grip the package. This gear should not be used on frail or smooth-surfaced packages. It should never be used for loading to or discharging from ship's hold. Its most important function is for lifting one end of a heavy package to enable a sling to be placed under it.

Plate Clamps

Plate clamps (see diagram) are used for lifting metal plates, e.g., ships' plates. They are fitted to a length of chain as is the case with dog and can hooks. Unlike them, however, each plate clamp is designed with two adjustable jaws which close when it is tightened, as happens when the sling takes the strain. For lifting purposes the clamps are placed one on each side of the plate and the jaws slipped over the edges, as soon as the weight of the lift is taken the jaws close and hold the plate in position until it is lowered and the sling slackened, when the jaws automatically fall open thus loosening their grip and allowing the gear to be released from the cargo.

Quick-Release Cargo-Handling Gear

The great advantage to be gained by using can hooks, plate clamps and similar "quick-release" cargo-handling gear, is that the gear can be taken away from the set immediately the lift has been completed. In all other cases the set has to be taken away from the gear, frequently package by package. As a result, when quick-release gear is used only one set of cargo-handling gear is required to each cargo hook, instead of three sets to each hook, i.e., one being loading in the hold, one swinging in the air and one being discharged on the pitch as is the case with ordinary cargo-handling gear, this works in reverse when a ship is loading. Quick-release gear is particularly valuable for working in confined spaces, e.g., deep tanks.



Cargo Nets

A cargo net is a rope net about 12-ft. sq., with a 6-in. to 8-in. mesh made of 2-in. cordage, framed with a stouter rope. The net is made with an eye at each corner. It is used by laying it out and loading the cargo on to it. It is lifted by a set of fours. (Sometimes the set of fours is dispensed with and the eyes of the net are placed straight on to the cargo hook of the derrick or crane).

Port Operation—continued

Considerable discrimination must be shown in using cargo nets. They are suitable only for cargo which can withstand the pressure of the net when the weight is taken, e.g., mail bags or strong small cases with no sharp cutting edges. They should never be used on their own for passengers' baggage.

Circular Net Boards

To widen the scope of the cargo net so that it may be used for cargo which would otherwise be crushed in the net, a circular board about 6 or 7-ft. in diameter and known as the circular net board has been introduced. It is used by laying it in the centre of the net, stacking the cargo on to it and then lifting corners of the net as described under " cargo nets."

Cargo Tray (Scale Board)

The cargo tray is made of wood, usually strengthened by metal, and measures about 5 to 6-ft. sq. To prevent cargo from slipping off the tray as it swings it has raised edges. It is fitted at each corner with an eye. Sometimes these eyes are fixed separately but often they are formed by turning up the metal bands which run diagonally across the underneath side of the tray for strengthening purposes.

When the tray is loaded it is lifted by a set (bunch) of fours.

The cargo tray is an extremely important piece of cargo-handling gear and should be used for any small or frail packages whenever there is a danger of any other form of gear crushing or " nipping " the cargo. " When in doubt use a cargo tray " is a good maxim for all operators to follow.

Because the fours, when attached to the tray and the cargo hook form a pyramid, it is possible that they themselves may nip or crush the top packages of the set. This danger may be overcome by (a) limiting the height to which the set may be stacked on the tray which has the effect of slowing down the rate of working by reducing the average weight of each set, or (b) placing four " spreaders," i.e., wooden or metal bars between the legs of the fours at a height from the tray which will enable the maximum height of set to be made up.

The Pallet

The pallet is a form of cargo tray constructed from wood. It is made square or rectangular and may be likened to a grating with a top consisting of a number of boards, usually about five, joined by three cross-members to three other boards laid parallel with the top boards, which form the bottom of the pallet. Unlike the cargo tray it has no eyes at its corners nor has it raised edges. Usual sizes are about 6-ft. by 4 or about 5 to 6-ft. square. It is hoisted into or from the ship's hold by means of fours joined at the free ends, in pairs, by two stretchers. Before hoisting, the stretchers are passed between the top and bottom of the pallet at each end and placed against the two outside cross-members. As soon as the pallet and its load are lifted the pressure of the stretchers on the cross-members automatically holds it is position.

The pallet may be used in the same manner as an ordinary cargo tray. It is designed, however, to be transported by the fork lift truck. This arrangement is operated by driving the fork lift truck gently forward so that the fork is manœuvred between the top and bottom gratings. When it is in position it lifts or lowers the set to the required level for travelling, as has already been explained.

This combination of pallet and fork lift truck is highly successful for handling cargo of a more or less homogeneous nature. By reducing double handling to an absolute minimum it (1) increases the rate of clearance from quay side or transit shed, (2) acts as an aid to labour and (3) reduces the possibility of damage to cargo, which in turn helps to remove one of the root causes of petty pilferage.

It also permits of uniform sets being piled four or five high in the transit shed or on the quay without additional handling. In reverse, cargo piled in this way may be unpiled and delivered to land conveyance. In this sense the pallet may be regarded as " self-stacking," for apart from the truck driver no additional man-power is required for piling or unpiling. This obviates the damage to and the soiling of packages which arises when labourers have to walk over them during piling and unpiling operations. It means, of course, that the pallets must be left in position when the cargo is stacked. This necessitates a large stock of pallets and a considerable area in which to store them when they are not in use.

During the war, in circumstances which enabled the formalities connected with cargo-handling in peace-time, e.g., Customs examination and sampling, to be dispensed with, occasions arose when cargo could be struck from conveyance and made up into sets in pallets, in the port of origin, and not removed from the pallets until it was loaded into conveyance at the port of destination. Such a simple system would rarely be possible in its entirety under normal peace-time conditions, but it does serve to illustrate the labour-aiding, time-saving and damage-avoiding potentialities of pallets and fork lift trucks.

Vehicle-Lifting Gear

Vehicle-lifting gear consists of four steel wire legs attached to one lifting ring. To permit of the legs being easily adjusted in length, they are each attached to a length of chain legs at the free end. The chain legs are in turn shackled in pairs to two steel mesh nets.

The vehicles to be lifted are pushed or driven on to the nets so that their wheels are cupped in the nets when slung, i.e., one pair of wheels to each net. To prevent the legs from nipping or crushing the body-work of the vehicles this gear is fitted with spreaders, slightly longer than the nets. Before the weight of the lift is taken, pads of cloth or similar material should be placed between the wings of the vehicles and the wire legs to prevent them being crushed or scratched.

Vehicle-lifting gear is almost invariably designed so that the number of nets can be increased according to the number of pairs of wheels on any vehicle likely to be handled.

Heavy Lifting Beam

For lifting heavy and long articles, e.g., locomotives, a massive spreader, known as a heavy lifting beam is used. It resembles a long heavy girder which is fitted with a ring or a hole for a shackle on the top side at the point of the balance, to enable it to be attached to the lifting appliance, and holes on the under side to which the cargo-handling gear supporting the lift can be shackled.

This gear is usually very heavy and may weigh as much as 10 tons. In consequence the student should note that the weight of the beam must be ascertained and added to the weight of the cargo to be lifted, before the total weight to be lifted is calculated for the purpose of ordering and rigging the necessary plant and gear.

Save All Net

For discharging or loading valuable cargoes, cordage nets are sometimes slung and made fast between ship and shore to prevent packages falling on to the quay or into dock water, in the event of gear breaking or cargo slipping out of a set. It must be remembered that owing to the normal shape of a ship's hull there is always a gap between ship and shore at the fore and after ends of the ship.

For normal working purposes the " save all " should not be used, for it offers an obstruction to normal quay working.

Part 5 (A) : Cargo Handling—Method

Cargo handling in port, dock or wharf areas whether inboard or outboard requires that each operator playing a part in the many functions should keep the following points always in mind, (1) safety of personnel, (2) safety of the ship, (3) safety and condition of the cargo, (4) economic and rapid turn round of the ship, rolling stock, road and water transport, (5) efficient and rapid disposal of cargo from the transit area.

Safety of Personnel

Statistics show that compared with other industries the percentage of accidents to workers employed in cargo handling operations

Port Operation—*continued*

in docks, both inboard and outboard, is relatively high. That this is recognised by the responsible employing authorities in all parts of the world is shown by the provision of medical rooms staffed with trained personnel and the arrangements made to supply first aid equipment and to train the operators themselves in its use.

The very nature of the work carried out in cargo handling operations makes it accident prone, but operators at all levels may do much to minimise the risks necessarily undertaken by (1) correct and efficient care and maintenance of cargo handling gear and plant, (2) use of the correct cargo-handling gear, (3) efficient maintenance of (a) lighting and (b) the white colouring on obstructions and quay edges particularly during foggy weather, (4) issuing clear and easily understood working instructions in simple language, (5) training and encouraging all personnel for whom they are responsible to obey safety first precautions e.g. standing away from under sets when they are being hoisted or lowered, tightening bights before lifts are made, inserting pieces of timber between chain slings and set of girders, giving and observing correct hand signals and not smoking in holds, (6) obeying instructions and observing safety first precautions, (7) implementing by their actions the training received.

Confidence on the part of workers in the reasonable safety of the operations being performed is an important factor in producing good tonnage results.

Safety of the Ship

The safety of the ship is at all times the responsibility of the master. He must be satisfied that the work of the operators engaged in loading or discharging his ship will not adversely affect her safety while she is in port or later when she is at sea.

The port operators' duty, therefore, is to observe, the master's requirements and to co-operate with him and his officers so as (1) not to get the ship out of trim so that she is unseaworthy. A, ship is out of trim when she is "down by the head", i.e. her bow is lower in the water than her stern or "down by the stern", i.e. her stern is lower in the water than her bow; (2) not to cause her to take a dangerous list either to port or starboard. A ship is said to be listing when she is not floating in a perpendicular position; (3) not to endanger the ship by stowing dangerous cargo without the master's knowledge or by giving it a stow which will endanger the ship and/or other cargo on the ship; (4) not to strain unduly the ship's structure by working her so that she (a) "sags" i.e. the keel assumes a bow shape with the amidships part nearer the dock bed than the bow and stern extremities or (b) "hogs" i.e. the reverse of sagging. One possible result of sagging or hogging is that if overdone the ship will not resume its normal shape. The effect of a permanent sag is that when the ship is down to her "marks" she is underloaded. In the case of a permanent hog she is overloaded when down to her marks; (5) not to endanger the ship by using incorrect or inefficient cargo handling gear; (6) not to endanger the ship by failing to observe correct fire and other safety precautions, e.g. smoking in holds.

Safety and Condition of Cargo

It is the duty of the port operator to play his part in ensuring that cargo arrives at its destination in the same condition as it leaves the point of origin. This he can do by (a) correct and careful stowing on ship and stacking on shore, (b) the proper use of the correct cargo handling gear; (c) the use of efficient cargo handling gear and plant; (d) efficient and careful shunting; (e) reasonable care in handling; (f) eliminating unnecessary double handling; (g) rapid disposal from the port area; (h) advising shippers not to export unsuitably or badly packed consignments; (i) providing efficient repair facilities at the quayside.

Turnround of Transport

The turnround time of a ship in port counts from the time she enters the port with the cargo for discharge or her passengers for disembarkation, until she leaves (clears) with her loaded cargo or embarked passengers. The capital, maintenance and running costs per day of ships range from a relatively few pounds in the case of small vessels to several hundreds for large vessels, including freighters. For this reason alone the turnround of ships is a subject of great importance to all port workers, for each day spent by a ship in port adds to the cost of transport. The present world wide shortage of shipping space gives even greater importance to the subject, for the shorter the turnround time the greater the number of trips which can be made during the life of the ship. This point can be simply illustrated by considering the case of a ship engaged on a regular ten day run between two ports which by saving one day on turnround each time it is in port can make one extra freight earning run every ten trips.

Port undertakings are vitally interested because the faster ships are worked the shorter time will the berths be occupied by each ship. This means a greater " berth user." Berth user is the expression used to describe the number of ships using a berth during a given period, generally one year. It is not the only criterion of satisfactory berth use and must be considered in relation to revenue earned and tonnage of cargo handled. To encourage rapid turnround many port undertakings levy a due which includes a limited free occupancy of the berth after which an additional daily charge is made.

Students should pay particular attention to the different aspects of ship turnround which will be referred to or become apparent during the examination of port operating in this chapter.

Similar considerations apply to the turnround of other forms of transport. The units are smaller and the influence of each is therefore less, but in the aggregate vast sums are involved and such important factors as congestion, clearance of the dock area, use of static facilities and size of the labour force are greatly affected as will be shown as these matters are examined in more detail.

Disposal of Cargo

It is the duty of port operators to ensure the quickest disposal possible of cargo from the transit area consistent with efficient port operation and the preservation of the sound condition of the cargo and its containers. This is necessary (a) to avoid congestion of cargo and transport; (b) to minimise the risk of damage, deterioration and pilferage; (c) to ensure the maximum use of the transit area.

In the case of exports rapid disposal of the cargo by loading it on to the ship is controlled under present conditions by (1) accurate timing of the day for opening for exports; (2) availability of cargo; (3) correct stacking in the transit area; (4) the rate at which the ship can be loaded, generally speaking the shore can beat the ship during loading operations; (5) the number of ports for which the ship is loading; (6) the standard of co-operation between the inboard (ship) and outboard (shore and overside) operators, particularly when two or more different organisations are concerned; (7) correct documentation; (8) the condition of the cargo, e.g., amount of repairs required; (9) the nature of the cargo, e.g., frail or dangerous; (10) the amount of Customs work; (11) well-trained personnel.

In the case of imports rapid clearance from the transit area depends on (1) the issue of prompt and accurate disposal instructions by the consignees; (2) the efficiency and keeness of the quay staff in acting upon these instructions; (3) the judgement displayed by the staff in anticipating the rate of ship discharge, and ordering transport where necessary; (4) the rate of discharge, normally the ship can beat the shore when discharging; (5) whether the ship can discharge complete consignments, this often depends on the thought given to loading at "the other end"; (6) correct stacking on shore; (7) availability of transport; (8) the amount of Customs work; (9) the nature of the cargo, e.g. frail packages require careful handling which slows up the work; (10) the condition of the cargo, i.e., freedom from breakages requiring coopering; (11) good documentation; (12) sound co-operation between ship and shore organisations; (13) well-trained personnel.

(To be continued)

A Notable Towing Operation

Large Floating Dock makes Transit through Suez Canal

BY A CAIRO CORRESPONDENT.

Behind the announcement of the recent arrival at a South Coast Naval dockyard of the Admiralty's newest and largest floating dock, A.F.D. 35, is the story of the dock's construction and the long tow of 6,000 miles, including the difficult transit of the Suez Canal, to England.

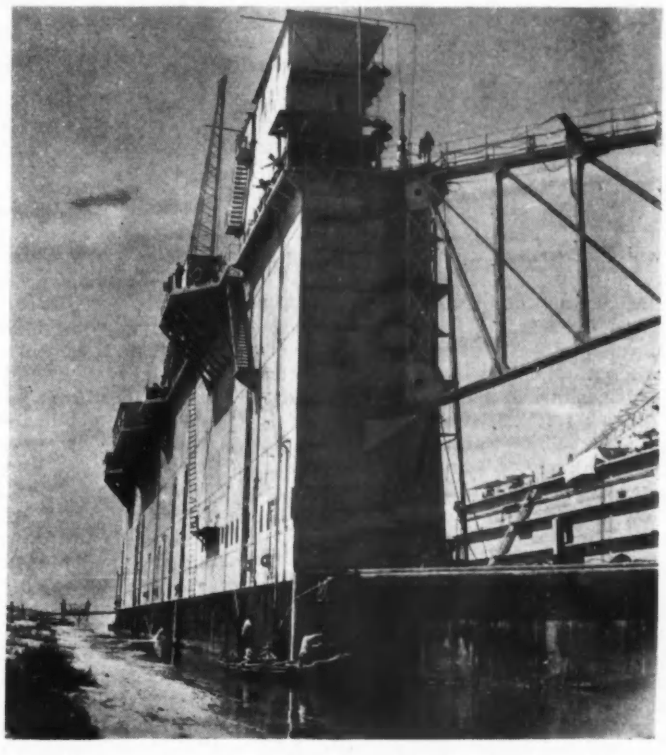
The fore and aft section of the Dock approaching El Ferdan Bridge.

Laid down at Bombay nearly three years ago, A.F.D. 35 was planned for use in the prolonged sea war in Pacific waters which was envisaged by the British Admiralty and the Supreme Allied Commanders, and which, but for the advent of the atom bomb, would undoubtedly have taken place. So far as anyone can judge, naval operations near Japanese bases or against Japanese aircraft carriers would have been for the Allies a costly sea warfare of a new but not entirely unknown type. Suicide Japanese airmen, piloting tons of high explosive, would have attempted to dive to the decks of capital ships and smaller battlecraft of the Allied fleet in attempts to inflict damage, which if not mortal, would certainly have put the victim out of commission for some time, even were full docking and repair facilities available. That adequate facilities were not available in ports open to the Allies in that theatre is proved by the decision, taken some time before VE-Day, to lay down in Indian shipyards a number of floating docks of varying lifting capacity. Until the new docks were in commission, vessels damaged beyond the aid of existing Naval bases would presumably have received first line repairs as soon as practicable and would then have been forced to steam farther afield before they could be refitted for action. There can be no doubt that the floating docks would have played a vital role in the Pacific war which every man, beyond the select few participating in the atom development, expected.

The problems of the atomic naval warfare which accompanied the sudden end of the war in the Pacific immediately claimed the closest attention of Naval experts who found themselves in the unenviable position of having to solve atomic problems in the light of insufficient information about the new weapon. Never-the-less, in the midst of this upheaval, the decision was taken to complete certain of the floating docks, notably A.F.D. 35. The contract for its construction had been given and a considerable sum of money had already been invested in the unwieldy structure that lay on the stocks, and in the circumstances it was a decision that no one will dispute, for A.F.D. 35 when in full operation will form an important major addition to Naval dockyard equipment, its dry-docking facilities being bettered only by the graving dock at Southampton.

A.F.D 35 was built in Bombay of parts pre-fabricated in Calcutta in the works of Messrs. Braithwaite, Burn & Jessop, of steel manufactured in India, some 28,000 tons being used. For ease in construction and its later towing to the port of operation, the structure was built in two sections. These were the fore and aft parts, temporarily joined, and the bulkier central section. In the Bombay yards, stone walls were erected between the dock sections and the sea, these barriers being demolished when the time came to launch the dock. When the two sections were launched and prepared for the long sea passage to Malta (which was then the base decided on) the workshop and crew quarters on board had been completed except for minor details, and all the material required for the dock's completion was taken on board and lashed down for the voyage. In addition to the officers and Naval ratings, an Indian crew of engineers and shipyard labourers was also taken aboard to accompany the dock to Malta.

The dock is 870-ft. long with a beam of 177-ft.; its maximum draught being 10-ft. The total weight of displacement is 28,000 tons and its lifting capacity is 50,000 tons. The inside measurements of the dock are approximately 150-ft. by 75-ft. high. The dock sinks by gravity to a depth of 48-ft. within two hours; and seven electrical pumps, capable of pumping 30,000 gallons an hour, evacuate the sea water when the ship to be dry-docked is in position. The whole operation of sinking, manœuvring the ship into position, pumping the dock dry and mooring and shoring the stranded vessel can be done in less than half a day. The dock is completely self-contained as a workshop unit. On the port side of the structure four oil-fired boilers each with a capacity of 20,000 lbs. of steam per hour and operating at a pressure of 20,000 lbs. per sq. in. are installed in pairs in two pressurised compartments employing the closed stokehold system. They are complete with all boiler house equipment, including feed pumps and steam-driven fans. They supply steam for three 1,000 kw. 3,300-volt turbo-alternator sets installed in two separate engine rooms. The



The fore and aft section safely through the bridge. Its shallow draft (10-ft. maximum) enables it to drift safely inshore while tugs make ready to tow her again.

high speed turbines run at 6,500 r.p.m. and are complete with condensers, circulating pumps and all connecting pipework. The converting plant includes 1,200 kw. of A.C. to D.C., two turbo-alternator rooms together with H.T. and L.T. control and distribution switch gear. Two ancillary Diesel D.C. generator sets with control switchboards having a total capacity of 250 kw. are

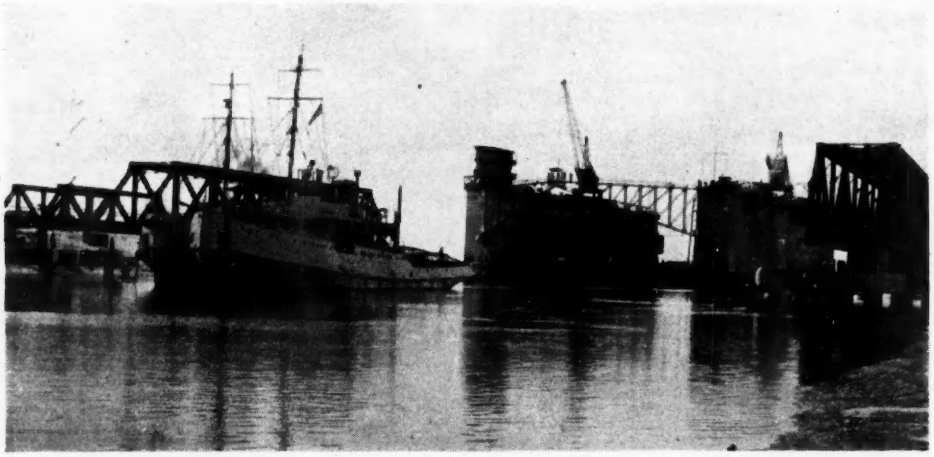
A Notable Towing Operation—continued

installed in separate engine rooms on the starboard side of the dock. The D.C. distribution scheme provides for coupling by means of two cross dock tunnels. Two evaporating plants provide 100 tons of distilled water every 24 hours. The inner dock wall is generously supplied with power points for the use of engineers and the stranded vessel's own requirements, and with compressed air and welding apparatus connections. Two travelling cranes, each with a lift of 2 to 4 tons, surmount the two dock walls. In addition, full toilet facilities for the crew of the docked vessel, up to a total of 1,000 men, are situated in the starboard wall, and there is also complete galley accommodation. The cost is believed to be in excess of £2,000,000.

The two sections of the dock left Bombay on March 20th, the Admiralty's two most powerful tugs, the sister ships "Mediator" and "Reward" towing the heavier centre section, and the tugs "Marauder," "Brigand" and "Hengist" towing the fore and aft sections. Accompanying them was the tug "Freebooter" which acted as liaison ship, carrying fresh supplies of bread and meat from the dock's bakehouse and stores to the other ships in the convoy while standing by to assist if needed. "Mediator" and "Reward," both twin-engined Diesel ocean-going tugs developing 3,200 horse-power, can steam 55 days, or 1,600 miles, without refuelling, burning only 7 tons of fuel daily. Towering over her tugs and appearing to dominate even the longer joint fore and aft sections, the centre part of A.F.D. 35 was nick-named "Snow White" at the start of the voyage from India, her escort appropriately playing the role of the seven dwarfs. Sixty fathoms of 22-in. rope formed a "spring" in the centre of the tow lines of 5½-in. wire, one-third of a mile long when towing. At sea, with the tugs towing abreast, 200-ft. apart, the centre of the tow lines was at times anything from 60 to 100-ft. under water. Sailing under favourable weather conditions (through spray 50-ft. high frequently swept the whole length of the dock while crossing the Indian Ocean), the convoy averaged 5.5 knots, a further half-knot being kept in hand.

The convoy arrived at Suez on April 14th, being forced to stand off the Canal entrance while awaiting favourable weather. The transit of the Canal, nowadays made in 12 hours except in exceptional cases, was planned to take four days to complete so that normal traffic along the great artery of the East would be inconvenienced as little as possible. It was arranged that the passage should be made in four parts: Port Tewfik to the Great Bitter Lake; then to Lake Timsah; and from Ismailia to Kilo 40 (i.e., 40 kilos from Port Said); and on the fourth lap to Port Said. Plans to overcome any difficulties that might arise, had been prepared beforehand by Canal experts, and the two most powerful tugs of the Suez Canal Company, "Atlas" and "Hercules" (3,000 i.h.p.) were kept standing by with steam up to accompany the eight vessels. Immediately before the convoy entered each section of the Canal, a small service craft belonging to the Company cleared the port and starboard buoys marking the fairway in order to allow the pilots more room to manœuvre the dock. A total of some 238 buoys were removed and replaced when the dock had passed.

The transit of the Canal was begun shortly after dawn on Sunday, April 19th, and the first lap was completed within a few hours. This part of the Canal is sheltered by the high banks formed by the excavation for the original Canal bed, and except for the entrance to the Little Bitter Lake where winds blowing across the lake strike the exposed hulls of large vessels, is free of snags. The second part of the transit to Lake Timsah was equally uneventful, but on the third section, pilots and navigation experts were faced with their greatest problem, the difficult passage through the British Army swinging railway bridge built at El Ferdan in the early part of the late war. The supporting piers of the bridge narrow the Canal here to only 222-ft., leaving a bare 22-ft. clearance on either side, and giving little room for drift in the event of a sudden wind springing up and striking the great expanse of hull. Any damage to the bridge would have disrupted Palestine-Egypt rail communication for anything up to several days and perhaps blocked the fairway for shipping for an equal period. Every eventuality that could be foreseen was provided for; but until the two sections arrived at El Ferdan and the prevailing weather was known the experts could not give definite orders. Admiral Lucas, Chef du Transit of the Canal Company, personally supervised the delicate operation.



The fore and aft section made fast while the two tugs pay out their tow lines and steam slowly through the narrow gap to take up position 400 yds. ahead.

The winching of the two sections through the bridge took six hours. First to negotiate the bridge was the fore and aft section, towed by "Marauder" and "Brigand." Steaming up the narrow waterway, and watched by a crowd of spectators, the two tugs towed the dock centrally in front of the open bridge then steamed through the gap, paying out their tow lines. Some 400 yards ahead they dropped anchor. Manilla ropes meantime had been run ashore from the dock by means of small boats and made fast to bollards on either side of the Canal, keeping the dock steady in the gentle wind which nevertheless could have run the great structure aground. Wire cables were also made fast to buoys specially moored in the fairway in the centre of the bridge and attached to winches on board the dock. Two tugs, acting as "rudders" took up the strain astern, their bows lined up on a small buoy specially moored in mid-channel, and slowly, inch by inch, the dock was winched through the bridge. The centre section of the dock was similarly dealt with. It was a delicate manœuvre, well planned and neatly executed in the minimum of time and without damage.

At 6 o'clock the same evening, four hours after the centre section had cleared El Ferdan bridge, a score of merchant ships, picking their way north and south through the Canal by powerful searchlights, passed the two docks and their tugs moored at Kilo 40. The next day the vessels entered Port Said and a few days later set out on the next stage of their journey, to Malta.

In charge of the operation was Commander H. N. A. Richardson, R.N., with Lt.-Commander R. D. Robinson, R.N., in command of A.F.D. 35.

Port Equipment Returning to Holland.

It is reported from Amsterdam that of a total of 5,300 tons of port equipment discovered at Hamburg, more than 3,000 tons has been, or is being, returned to Holland. The plant includes a complete quay installation, with loading stages and cranes, most of it having been removed by the Germans from Rotterdam and Dordrecht.

The Port of Catania

A Prominent Sicilian Port*

By DOTT. ING. AGATINO D'ARRIGO, Director of the Port Works.

(Continued from page 118)

CHARACTERISTICS OF CLASSIFICATION: MOVEMENT OF NAVIGATION AND PORT TRAFFIC.

The harbour of Catania, notwithstanding the exposure of the district in which it lies, open to the storms of the entire Mediterranean, and despite its essential protective functions respecting human life and navigation, has not been classified as a Harbour of Refuge. By Government decree it has been assigned to the 2nd category and the first class.

Under the legislation in force on the matter, the administration has determined harbours and beaches to be in two main categories. To the first category appertain the harbours and beaches affecting the general safety of navigation and those which serve solely or principally as refuges or for the military defence and security of the State. The whole of the expenditure relative thereto is borne exclusively by the State.

In the second category, on the other hand, belong the ports and landing places devoted to commerce, and towards these the State makes only partial contribution in direct ratio not to the degree of exposure but to the importance of their traffic.

Ports and landing places in the second category are divided into four classes. Those of the first class are located at the head of important lines of communication, the commercial movement of which serves the outlying parts of the kingdom and world wide international traffic. This makes them of general interest to the State. Others are those which, although not situated at the terminals of great lines of communication, have the same qualification of being of general interest to the State and at which the quantity of goods loaded and discharged has been not less than 260,000 tons in any of the preceding three years.

It is clear that the classification in question presents the imperfection of singling out a few of many fundamental elements in the characterisation of harbours and does not exclude the factor of value of the goods, but only the quantitative aspect, without reference to the physiographic nature of the locality in which it lies and selecting, moreover, the consideration which it is not always possible to discriminate proportionately where commences and ceases the protective function of a harbour and the complex and often anomalous departments of commerce and fishery, of coastal service and of shelter for the smaller craft.

So much so, indeed, that it has been necessary to interpose in this important question with arbitrary restrictive or expositionary interpretation, in any case fatally hybrid.

"The division into two great categories has anomalous results not only for ports in their entirety, but for the works themselves, in such fashion that in the same harbour there may be works of the 1st and 2nd category. Thus, in a harbour of refuge which comprises works relating to commerce, the protective breakwaters for the inner area are in the 1st category, while the other works are in the second category."

The question has been posed in a masterly manner, analysed and detailed as regards fishery ports with mature competence and, above all, with courage for the first time by Prof. Dr. Ing Luigi Greco, President of the 3rd Section of the Supreme Council of Public Works and an eminent exponent of Maritime Construction at the Universities of Rome and Naples, on the occasion of the First National Fishery Congress, 20th March, 1946.

The resolution unanimously approved by the Congress was as follows:—

> "The first National Fishery Congress, having heard the statement of the Ing. Prof. Greco, recognises the necessity of making a revision of the classification relating to fishery ports;
>
> "Recognises the essential pre-eminent importance of the fishery industry in the national economy and regards as inadequate the provision made in the past for the systematisation, the implementation and the creation of fishery ports;

*Translated from the Italian.

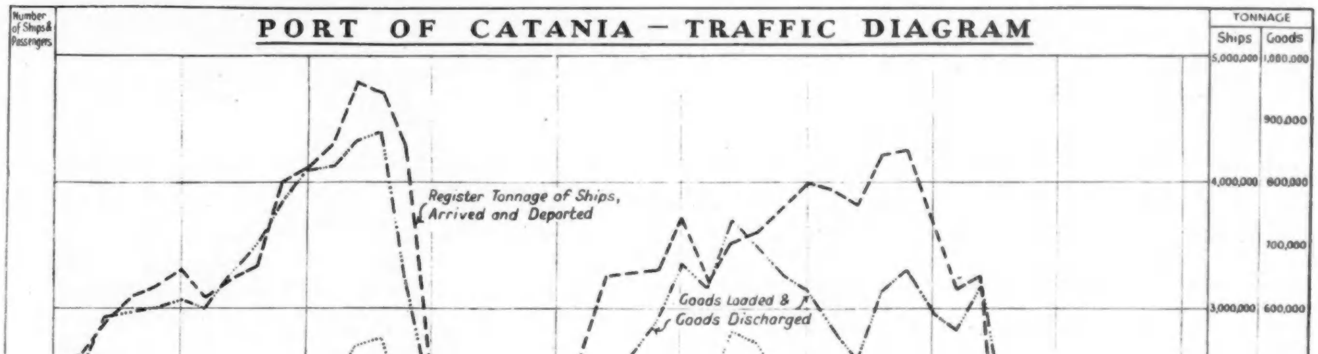


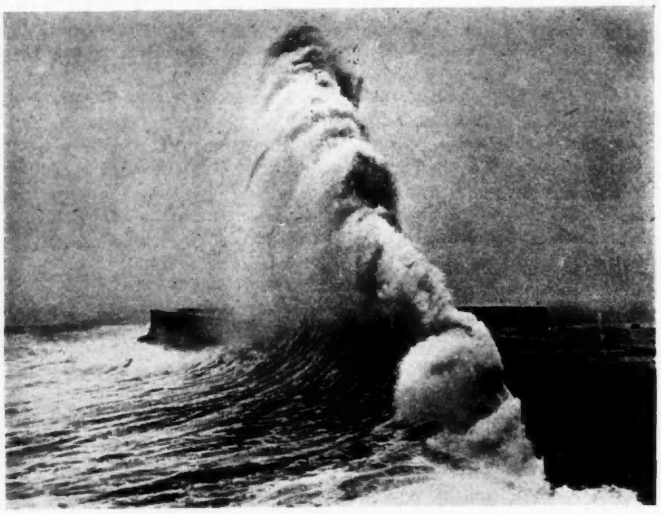
Fig. II.

Port of Catania—continued

"Considers that the organic law on maritime works of the 2nd April, 1885, No. 3095, in the legislation for ports is based exclusively on the tonnage of goods loaded and discharged, and does not envisage the special requirements of fishery with the object of benefiting by the direct intervention of the State in works designed for the refuge and traffic of fishing craft;

"Resolves that the Government should revise the classification of all fishery harbours, taking account primarily of their organic function of providing adequate shelter and a base for fishery craft by including in the first category the existing works or those to be constructed for the purpose."

Evidently there is an urgent necessity also for a radical revision of the present classification of the other harbours, especially those like Catania. Placed in the 2nd class, 2nd series, with the smaller fishery ports of the eastern coastline of Sicily (4th class), they remain naturally exposed to the destructive force of oceanic violence and are most dangerous for the safety of human life in the dynamic action of the sea in time of storm, not only as regards Italy, but the whole of the Mediterranean.



Storm of 5th-10th January, 1940. Superstructure with outer parapet wall having parabolic profile Reflected Wave.

The legislation in force for harbours signalises all this and bases fundamentally their classification on the over-all tonnage of goods loaded and discharged, which constitutes the index of traffic balance on which basis port works are exclusively assessed.

In Fig. 2 is shown a diagram of the harbour traffic of Catania from 1900 to 1946. It would have been interesting to give a comparison with preceding data commencing from 1861, but the particulars relating to goods loaded and discharged at individual ports only commenced to be recorded in 1881 (Catania, 1881, 295,119 tons loaded and discharged), the year in which the publication of navigational returns passed from the Ministry of Agriculture, Industry and Commerce to that of Finance, and the collection of statistical information passed from the Captaincy of the Port to the Customs Authority. Previously the statistics of the Marine and Agriculture Department gave only the register tonnage, a purely conventional figure which represented the internal capacity of the ships and did not measure the degree of importance of the port traffic.

Thus, while at Catania the mean annual number of vessels (steamships and sailing craft) arrived and departed in the two years 1861-62 was 2,581, it was 8,772 in 1912 (max. value, 1900-1945; min. value, 735 in 1941; mean value, 5,277).

So, too, while the mean annual register tonnage of shipping arrived and departed in the two years 1861-62 was 117,565, it reached 4,800,176 in 1912 (max. value, 1900-45; min. value, 30,348 in 1944; mean value for the 45 years, 2,823,289).

The tonnage of goods unloaded in the 45 years reached a first max. value prior to the first global war in 1913 with 556,036 tons and a second max. value of 570,048 tons in 1927, the absolute max. value between the first and second global wars.

The tonnage of goods shipped during the same 45 years reached the absolute maximum prior to the first world war in 1910 with 362,288 tons, and two other relatively maximum values of 200,707 tons in 1925 and 203,133 tons in 1933 in the period between the two world wars.

The combined tonnage of goods loaded and discharged has reached the annual mean of 370,000 in the quinquennium 1886-90 and was exceeded by the mean of 450,000 in the ten year period following.

It attained an absolute maximum before the first world war in 1913 with 880,753 tons, and a succeeding relative maximum of 745,642 tons in 1927 (mean value 544,662 tons for the period 1900-45).

Nature of Trade

The principal imports of the port are the following:—Fossil coal, grain, timber in logs and sawn, limestone, cement matrix, maize, fertilisers, mineral oil, petroleum, benzine, naptha paraffin and colophany, seaweed, chemical products, raw hides, charcoal, paper and pasteboard, oats, scrap iron, steel and cast iron, pig iron, iron and steel bars, vegetable oils (edible and industrial), marble and pozzuolana, barley, coffee, sugar, cocoa, drugs and substitutes, materials for painting and tanning, colours, varnishes, stock fish and other preserved fish, vegetable and animal tallow for industrial use.

The principal exports are as follows:—Oranges and lemons, crude and manipulated sulphur, almonds, nuts, pistachio and dried olives, beans, mustard seed, wine, potatoes, olive oil, citrus fruit rinds, apple jelly, bitumen and asphalt, dried vegetables, liquorice juice, cork, lavitic stone

Discharged goods arrived mainly from abroad; loaded goods were mainly consigned to foreign parts. Movement in transit and re-exports were insignificant.

Merchandise from abroad, apart from a negligible quantity destined for local supply and re-export, came from all countries to the Catanian Customs. Alone there was a certain outward movement for the supply of coal to shipping.

As regards imports, it may be noted that the chief items are grain, coal, wood, cement. In exports, citrus fruits, sulphur and almonds are the chief items.

In regard to grain, there should be noted the importance of the provincial milling industry. Such industry, fortified by semolina, has expanded throughout Italy, even in Tuscany and Venetia Giulia, succeeding in beating the competition of the local mills.

And there can be foreseen for this trade a transport traffic which hitherto has failed—and which could instead assume non negligible proportions—not through deficiency, but through the complete absence of the least mechanical equipment.

In fact, it frequently happens that some steamships with a complete cargo of grain for the Mediterranean call at Catania to unload the portion which, from the setting out or during the voyage, has been sold to local mills or those of the interior and pursues its way with the rest of the unsold grain to discharge it in the silos of other ports, awaiting its disposal. Such silos at the Port of Catania would have rendered possible the landing of the unsold portion, thus providing a not inconsiderable traffic.

The movement of coal would necessitate mechanical appliances for discharging and loading with a notable economy in the actual charges for unloading, thus making convenient coal bunkering at Catania in preference to other ports.

Up to 1907, imports and exports balanced one another; thereafter, there has been a differentiation in favour of importation.

The extraction of Etna lava has attained a moderate importance and, in addition to assisting the local building industry, it has provided exports by means of sailing and motor craft to the ports of Messina, Reggio-Calabria and of Egypt in the form of sculptur-

Port of Catania—continued

able stone, anti-corrosive boiler material, for chemical use, and for plinths and copings for maritime works.

The import of wood supplies the workshops for naval construction for wooden craft, for musical instruments and for casings in which citrus fruits are packed for export. This last industry in particular gives rise to a notable import of timber, which has occupied 3rd place in rank among imported goods.

Attention should also be called as regards exportation to the osier industry and that of stringed musical instruments, in which the City of Catania holds primacy of production and exportation among all goods, not only national but also abroad.

A notable and important chemical industry is that of the "Montecatini" concern at Bicocca, which is engaged almost exclusively in the manufacture of chemical fertilisers. It obtains through the port its essential material, Tunisian phosphates, the imports of which before the war were almost entirely consigned to the concern.

Damage Sustained in the Outer Defence Works, in the Port Establishment and in the Zone in Front During the Second World War

The second world war caused heavy damage to the works of the harbour, resulting in the greatest ruin for the enemy's delicate nerve point, constituted into an outer defence onslaught in that Gulf of Catania, which receives in all fullness the greatest of the southern storm wave, so wonderfully described by Dante in the tiercet of Paradise (VIII: 67-69):

> E la bella Trinacria che caliga
> tra Pachino e Peloro, sopra il golfo*
> che riceve da Euro maggior briga

and so, unfortunately, often and fatally forgotten, in our time, by legislators and celebrated technicians.

Euros, in fact, is the most ancient Greek name of the sea, caused by the easterly wind.

When the compass-card was compiled, that is in the epoch of the Ionic school, not only with the poets, but also in the practice of the navigators, Euros continued to designate the wind that comes from east, while the scientists name the real easterly wind "Apeliote" and Euros indicates the Sirocco wind.

The actual damage sustained by the harbour of Catania is immense, very much greater than that part, very approximate though it be through deficit, which it has been possible up to the present to restore to public control.

It suffices to relate that only in the last few months has been begun the task of opening out in the sea area, immediately adjacent to and in front of the harbour, fundamental preliminary operations which alone can assist in disclosing completely the substructure of works visibly disruptured—almost totally.

These operations of examination are lengthy, delicate and particularly difficult and dangerous, so much the more as the area of marine floor to be treated amounts to about 106.7 hectares (area of port internal water space, 66.7 hectares, and of the outer harbour, 40 hectares), greater, that is, than that of the natural harbour of Messina (82 hectares), while the mechanical appliances at disposal are only too exiguous and by a long way disproportionate to the mass of destruction.

The more visible war damage—which represents, of course, only a part of the total, not all of which has been disclosed because massed in a large measure under enormous layers of sand and masonry, which hide the greater part of the subaqueous substructure—which up till now it has been possible to determine, due to the infliction of a lengthy series of non-stop bombing, that is of uninterrupted attack concentrated on the harbour area and culminating in the summer of 1943, is as follows:—

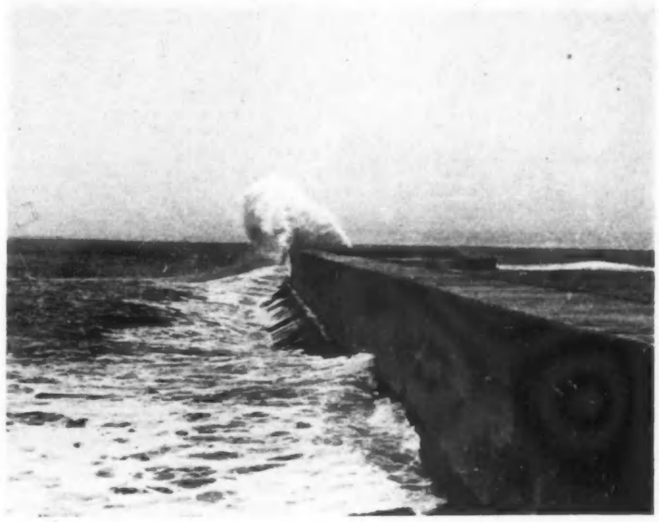
Over an area of about 2 kilometres of external defence, little less than half appears seriously dismantled in the under water mound—where projects a triple band of obstacles for commandos and the means of maritime assault—and more still along the sloping cut of the outer slope formed by artificial blocks.

Over an inclusive extent of 5 kilometres of internal quayage, a little less than one-half appears destroyed or damaged, while the remaining portion shows the quay walls radically disturbed in such a way as to allow of the escape of the sandy material which constitutes the back filling, seriously interfering with the stability and security of transport by reason of continuous filtrations of sand, which pass in and out to be deposited in the berths, and so diminishing the depths available for berthage.

Of 314 cast iron mooring bollards which the port possessed in the pre-war period, some 231 have been completely destroyed, and the remainder have their anchorages damaged.

Also completely destroyed is the whole of the mechanical equipment for the loading and unloading of cargoes (5 cranes in the Customs area, of which 1 is electric and 4 hand-worked).

The electrical illuminating plant has also been entirely wrecked and more than half the railway sidings connecting the Central Jetty with the main line of railway.



Storm of 5th-10th January, 1940. Superstructure with outer parapet. Wave stroke at angle of work.

The following port service buildings have been destroyed or seriously damaged: The Central Customs and Office, the Captaincy Office, the offices of the Maritime Section of the Civil Engineer's Department, Wireless Telegraphy and the Sanitation Dept. Also a number of warehouses and commercial establishments.

Five vessels sunk in the inner harbour and the outer harbour add to the adverse balance of the disastrous experience.

In order of magnitude, roughly approximate for the reasons previously given through defect, the war damage sustained at the harbour of Catania, selecting the works necessary to the restoration only just begun, can be set out to the 31st December, 1946, as follows:—

Repairs to and consolidation of the outer defences	600,000,000 lire
Dredging of obstructions of sand and masonry with the removal of foundered craft	400,000,000 ,,
Wharves and back-filled areas ...	350,000,000 ,,
Security measures for the substructure and its consolidation	300,000,000 ,,
Railway sidings and repairs to track ...	250,000,000 ,,
Bollards, buoys and mooring rings, gangways, etc.	250,000,000 ,,
Illumination installation, transformer huts and mechanical equipment ...	150,000,000 ,,
Port service buildings and kindred works	200,000,000 ,,
Warehouses, commercial establishments and concessions	100,000,000 ,,
	2,600,000,000 ,,

* Gulf of Catania.

Port of Catania—continued

In all to the 31st December, 1946, the cost of the works in course of execution at the port which have been rendered possible amount to about 136,000,000 lire.

Those in course of investigation and approval in relation to present financial resourcts will cost about 230,000,000 lire.

Order of Gradual Priority in the Reconstruction and Repair Programme and of Improvement Necessary for the Efficiency and Capability of the Harbour

From what has been stated in regard to the general situation and the particular condition in which the works of the harbour find themselves, not only in the framework of their reconstruction and repair, but also as regards their completion and improvement, it is evident that to solve the vital problem of the very existence of the port, operations are necessary in the following order of priority:—

Storm of 5th-10th January, 1940. Outer Mole seen from the interior of the Harbour. Reflected Waves similar to those observed and studied by da Vinci.

1. The restoration and consolidation of the inner Eastern Mole, and the exterior breakwater, most unfortunate in Italy, because subjected to storms of oceanic force and therefore more critically located than all the Mediterranean ports. It is furthermore necessary that the balance sheet assignment shall include its extension by at least a hundred metres, in order to avoid the pernicious effects of actual shock due to the lack of shelter in the internal basins from the outer seas in the sector of greatest storm still free to penetrate directly into the harbour entrance. Moreover, a revision of the classification itself of the harbour appears inevitable for reasons given above, to admit of its transfer to the 1st category.

It is opportune then for Catania, on account of its particular situation and the technical experience of the recent past, to reconstitute the deserving and traditional "Breakwater Works" analogous to, and as already instituted in Italy, the constitution of the Autonomous Consortium of the Port of Genoa, at Venice by the Water Magistracy, and in France by the Autonomous Port of Bordeaux.

2. Urgent provision of the protective completion of the underwater mole, already foreseen since 1923, in order to obviate, or at least to minimise, the accretion due to superficial action of the turbid stream of the Simeto, uncontrolled and therefore free to wander, the greatest and most turbid river of Sicily, which threatens the very existence of the harbour, prejudicing, moreover, one of the most extensive and most susceptible in tourist value bathing stations in the Mediterranean—that of the Plaia.

The training of the mouth of the Simeto would require safety measures also for reducing the peak of the floods, with consequent relief to the Catanian Plain.

Also here experience suggests the realisation of the excellent local technical project for the training of the outlet of the salt water reservoirs of the Prince of Biscari, works of art which have been obliterated, but by reason of the expert view of Emy, the Pithagorean masterpiece of the art of overcoming floods, which suggested to John Scott Russell the celebrated lapidary maxim of "converting these dangerous enemies into powerful slaves."

3. Essential repairs to the quay walls of the harbour berthage, with particular attention to the consolidation of the substructure and with provision specially suitable to achieve the stabilisation of the reinforcing earthwork wherever it is not possible to render watertight the gaps in the structure disconnected by their rupture.

4. Dredging the bottom of the inner harbour, paying special regard to the outer foot of the quay walls where the tie bars of the original foundation are to be reinstated. It is necessary also to proceed with the removal of the remains of sunken craft lying within the harbour area.

5. Stationary, mobile and floating plant for loading, discharging and depositing goods in the port area previously completed with rail connections, not only reciprocally and respectively between the actual quays, but also between these and the depot of miscellaneous goods of the Acquicella beyond that of the Central Station of the State Railway and Circum-Etna line.

6. Enlargement of the present Eastern Quay on the inside of the old outer breakwater, now functioning with least effect.

7. Demolition and reconstruction on another site of the present Biscari lighthouse, levelling of the lavitic surface adjacent, connection in course of time of the Francesco Crispi Quay with that of the Southern Mole.

The existing Fishery Harbour, not too happily situated as regards site for extension and equipment, could find a worthier and more suitable location within the vast area of the former salt water reservoir of the Prince of Biscari, lying outside the present Commercial Harbour, sheltered by the Outer Harbour and sheltered also by the second South Mole to the south of the existing one, as foreseen, with fixed repairing basins in the enlargement with second priority already included in the project for the port from 1923.

The reconstitution of the renowned salt water reservoir of Biscari as an appendix, with suitable trained entrance from the New Fishery Harbour will enter into the illustrious tradition, interrupted only in modern times, of the ancient and forgotten Works of the Breakwater.

8. Improved utilisation of the vast area (about 30,000 sq. metres) resulting from the closure of the old Alcala Basin that Zahra and Fiocca had preserved to diminish the wave shock in the harbour, functioning as an expansion basin to dissipate without reflection the undulations of rough seas, whose undeserved inglorious end has been of no benefit whatsoever.

9. The Breakwater Works ought to have available, automatically and continuously, among other things, at least one steam driven craft with modern equipment and sounding appliances of an economic reflectory type, forming a psammographic laboratory for the analysis of sedimentary deposits of the sea floor, of at least two photogrametric apparatus linked in parallel, of the Zeiss Heligoland type, for the systematic delineation of storm wave characteristics and of a complete maregraphic endowment of self-registering venturimeters, placed suitably in a sheltered position outside the outer breakwater, if not along the zone of most characteristic exposure of the Etna lava edge of the Gulf of Catania.

10. It would be judicious to decide upon a scheme within the limits especially of regional requirements and of the local conditions for a gradual financial plan to face the needs of the harbour, co-ordinating them with the general plan of installations for port equipment, with delimitation of the eventual Free Port area, reserved for the movement, in and out, of foreign goods subject to Customs Duty, and of the eventual Customs Port, reserved for the movement, in and out, of national or nationalised goods and of foreign goods not subject to Customs Duty, excluding the appropriate industrial zone, re-investigating accurately and daily weighing how much has been prospected since the distant 1927 and how much has been substituted in its time by the concessionary Company for the construction and use of the cargo handling appliances, taking account, of course, realistically of the present conditions of affairs.

Habits of Marine Organisms

Excerpts from Report of Marine Borer Research Committee, New York Harbour, December, 1946*

Committee Foreword

It has been estimated that, each year in United States waters, there is a loss of fifty million dollars resulting from attacks of the enemy of wharf structures—the marine borer. In Boston alone, a single species of marine borers attacking a large wharf did three million dollars damage. In a long-range project to insure adequate warning of possible marine borer attacks within New York harbour, the Marine Borer Research Committee has conducted a continuous study of conditions which might result in marine borer activity in the piling and other foundation structures of this great harbour area.

Collapse of Brielle Bridge, New Jersey, U.S.A., August 20th, 1946, due to attacks on pile foundation by Teredo and Limnoria.

Organised in 1938 to co-ordinate studies on the marine borer situation within New York harbour, the committee is an informal organisation of representatives of public agencies and private corporations. Its primary aim is to keep the harbour alert to possible infiltration of attacking marine borers. The committee's procedure has been to encourage waterfront property owners to submerge test boards at strategic points in the harbour and to arrange to have one block each month taken away from these boards for analysis at the laboratory of the committee's consultant. In this way the existence of a trace of borer activity, or of the growth of associated organisms, can be discovered promptly. There are now 44 of such committee test boards in New York harbour. Many of them carry a complete record of marine borer activity for as long as six years.

Introduction to Report

Records of the Port of New York reveal that marine borers were active in the latter part of the 19th century. Later, however, sewage and industrial waste in the harbour waters created conditions which minimised marine borer activity. The sharp decrease in marine borer life within the harbour led builders to construct many pier substructures and other water facilities with untreated piling.

With the gradual lessening of harbour pollution, it is essential to maintain vigilance against a possible revival of marine borer activity. There is no evidence of a serious marine borer attack within New York harbour at present. But active borers have attacked unprotected wooden pile structures in the vicinity of the Narrows and City Island.

Factors Affecting Marine Borer Growth

Exhaustive studies in connection with the test board surveys have been conducted for many years in an effort to determine the likelihood of marine borer activity at specified locations. These studies have shown that conditions for marine borer activity generally are more favourable where the water temperatures are high during the breeding season; where the salinity is not far below that of normal sea water; where the dissolved oxygen and hydrogen-ion content are high and the food supply is plentiful (a hydrogen-ion concentration lower than 7, on the acid side, is usually an indication of heavy industrial waste or other heavy pollution). Lack of these essential factors will tend to deter marine borer activity.

Factors Indirectly Affecting Borer Growth

Studies by the Clapp Laboratories at Duxbury, Mass., based on the inspection of test boards and records from hundreds of locations throughout the world, now indicate that several factors which were at one time considered as controlling the variations in marine borer growth, in reality influence this growth only indirectly through their effect on food supply for the borers. It is true that favourable conditions with respect to these several factors are necessary for continued borer activity, but they do not, in themselves, explain the periodic variations of marine borer growth. These factors are considered separately below.

Temperature.—In the early years of marine borer research, water temperature was considered one of the most important factors contributing to marine borer activity. Water temperature ranges were collected at more than one hundred locations where test boards were employed. Many thousants of daily water temperatures, recorded at Woods Hole, Gloucester and Boston for more than fifty years, were obtained from the U.S. Bureau of Fisheries. In 1934, a careful analysis of temperature records was made at the Duxbury Laboratory. The New England species of Teredinidæ were found to be only slightly affected by considerable variations in water temperature during the seasons of activity in spring, summer and fall. The various species showed no change in activity, although the tests covered a much larger range of water temperature than actually would occur at a single location over a period of several seasons.

The only exception to this negligible effect of water temperature upon marine borer activity occurs in Nova Scotian waters where, during the short breeding season of one or two weeks, the temperature may not become sufficiently high to enable the borer embryos to survive. The analysis also revealed that once the borers have entered the wood, any effect due to water temperature is greatly reduced.

Salinity.—At one time, the salinity of the water was also considered a vital factor affecting the activity of the Teredinidæ and other molluscan borers. Heavy sets of Teredo navalis may be found in those harbours which have a constant salinity of from twenty to thirty parts of total salts per thousand. Recent studies, however, have revealed that a variation of ten parts per thousand has no marked effect on the marine borers. Few harbours have a variation of more than two or three parts per thousand over a period of years.

In earlier days it was believed that possible variations in quantities of some of the less plentiful salts normally found in

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* Issued by Department of Port Development, Port of New York Authority, Walter P. Hedden, Director.

Habits of Marine Organisms—continued

ocean water might be responsible for variations in marine borer activity. An exhaustive study was therefore undertaken at twenty locations along the Connecticut shore. Careful records were kept of the number of Teredo found in special test boards during an entire season. At the same time, several thousand analyses were made of samples of water at different depths in the vicinity of the test board locations. These studies revealed conclusively that the slight variations of inorganic elements normally found in salt water had no effect on the presence or quantity of Teredo.

Pollution.—It is certain that marine life of all kinds is affected adversely by certain types of pollution. Marine organisms do not exist in heavily polluted waters. Their non-existence is not due to the presence of sewage in particular, but perhaps to industrial wastes, oil and other forms of pollution in the water.

Pollution does not appear to be responsible, however, for the annual periodic variation in marine borer activity in any particular location. Annual variations in the amount of pollution in practically all harbours have been found to be slight, yet there have been definite changes, from year to year, in the activity of the marine borers.

No measurable change in the existence of marine life has been found in certain harbours where radical " purification " programmes have been undertaken. However, in one instance where *all* treated sewage effluent has been carried completely outside of the harbour, there has been a sharp increase in marine life, including the marine borers. Where a purification programme is limited to one or more types of treatment and where the discharge into the waters still contains industrial wastes, oil and possibly additional chlorine, there has been no evidence of increase whatever in destructive marine organisms.

The annual variations in the extent of marine borer destruction cannot be related directly to changes in the amount of pollution present. Harbours in which no trace of pollution has been found, still show great variations from year to year in the numbers of marine organisms.

Food Supply Directly Affects Borer Growth

Many students of marine borer life have published evidence that molluscan timber borers tunnel into wood in order to obtain food. The committee's consultant does not believe this finding to be accurate. It would be out of the question to assume that the closely related rock borers, the Pholads, obtain any nutrition from the concretes, marbles, shale and similar materials in which their burrows are formed.

Shipworms are bivalved mollusks. Hundreds of species of mollusks burrow into various materials, undoubtedly to protect themselves from predatory enemies. Among the better known bivalves is the common or soft clam of the Atlantic Coast, the Mya arenaria. This mollusk inhabits deep burrows in mud and sand flats, but does not obtain food from the mud or sand in which it burrows. Its principal food supply consists of diatoms and other micro organisms obtained from the water outside of the burrow. The clam accomplishes its feeding by means of a syphon extended from the body of the animal, deep in its burrow, to the entrance of the tunnel where the clam's outer end is in contact with the water. None of the marine bivalves which drill in mud, sand or rock, are dependent for food upon the material into which they burrow. It seems probable that they burrow as one method of escape from carnivorous enemies, just as do many species of worms and other marine invertebrates. It seems illogical to believe that of all the many species of burrowing mollusks, the shipworm alone should be drilling for food.

If the Teredo consumes micro organisms in the water, rather than from timber, we might account for yearly variations in the presence of Teredo as the result of periods of abundance or scarcity of food.

The food of the common oyster consists of the same minute organisms which furnish nourishment for all other bivalves. It is known that oysters are poor in years when their food supply during the growing period is limited, and conversely, that they thrive in years when the food supply is abundant. Published records indicate that, in abnormally dry seasons, the food supply for the bivalves is sharply curtailed and that oysters, particularly, are undernourished. As a consequence of these dry periods, growth and multiplication of the bivalves is retarded. In years when the rainfall is heavy, the streams carry down to the harbours a vast supply of microscopic food.

It seems logical to believe that the same factor which causes favourable or unfavourable seasons for the oyster also is responsible for the unpredictable variations from year to year in the activity of the Teredo and other molluscan borers. Recent studies have indicated that this may be true.

Where the Hudson River flows into New York Harbour, the salinity above 125th Street is generally believed to be too low to support more than a few scattered, exceptionally hardy shipworms. During a recent unusually dry season, however, it was reasonable to assume that the salinity in the lower Hudson would be higher than usual, and thus would provide favourable conditions for borers. Based on this assumption, it was predicted that unusually severe marine borer destruction might occur in that area. Surprisingly enough, fewer marine borers appeared during that dry season than in previous years. It was learned later that oyster beds also had suffered during that season. It is, therefore, possible to believe that food supply is an important factor in governing marine borer activity. Temperature, salinity, and similar influences, which indirectly affect *micro organisms* forming the food supply, rather than the direct effect of these factors on the *marine borers*, may control the existence of these organisms and the destruction for which they are responsible.

It would be of inestimable value to know in advance when the periods of exceptionally severe destructions by borers will occur. Records dating back for many years show that marine borer activity has tended to vary in some harbours at more or less regular intervals. These intervals may be associated with variations in the food supply. It would seem, therefore, that studies on the variations in the food supply of marine borers would be the most promising field for future research in our efforts to anticipate borer activity.

General Summary of Results for New York Harbour

The records from the laboratory examination of approximately 8,000 individual test panels indicate that the activity of Teredo navalis over the entire New York area, both in the inner and outer harbour, had an upward trend from 1938 to 1941, when a peak was reached. Teredo activity then showed a sudden drop in 1942 and virtually disappeared for a period of several years. In the past year, light attacks have again appeared. In no case, however, have the tests indicated serious Teredo activity within the inner harbour.

Similarly, the Limnoria attacks showed an upward trend from 1938 to 1941. A low point has been reached in the years since 1942 and activity still remains at a low level. To date, there has been no evidence of Chelura or Martesia attacks in New York harbour.

Port of New Westminster, British Columbia.

The Annual Report of the Port of New Westminster for the calendar year 1946 shows satisfactory gains over any year since 1940 with exports maintaining approximately the same high levels as were experienced in pre-war years, while, at the same time, a substantial increase in the arrival of deep-sea vessels was recorded.

Marked gains are shown in major commodities exported, such as lumber, fir ties, book shooks, plywood, chemical fertilizers, and fresh apples, and shipments of wheat constituted a record.

The resumption of world-wide trade and commerce will have a great influence on the future growth and development of the port. There is much room for industrial expansion on the Fraser River and a settling of world problems will be reflected in an increase of ocean-going shipping in this port, as well as all Pacific Coast ports.

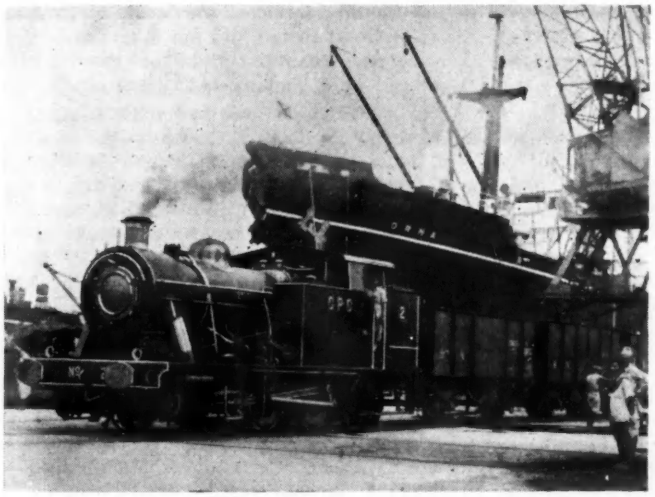
The number of coastwise and ocean-going vessels visiting the port during the year was 4,832, totalling 3,305,564 net. reg. tons, and the volume of cargo handled amounted to 2,315,492 short tons (2,000 lbs.) compared with 1,957,740 tons in 1945.

Quayside Shunting at the Port of Calcutta

Introduction of Six-coupled Tank Locomotive of Special Design

Heavy dock shunting at the Port of Calcutta is now being undertaken by six steam locomotives of a special design evolved by the consulting engineers, Messrs. Rendel, Palmer & Tritton, and the builders, The Hunslet Engine Co., Ltd. The locomotives were put into service during the latter half of 1945 and their success is evidenced by the recent placing of a repeat order for a further six locomotives. The problem was to produce a 5-ft. 6-in. gauge locomotive capable of hauling trains of 1,280 tons weight, made up of 40 wagons; to keep within a maximum axle load of 17 tons, and to haul the load round curves of 300 feet radius. Sufficient fuel and water for 12 hours of continuous work were to be carried.

Weight reasons alone dictated an eight-wheel locomotive, but in view of the sharp curvature all the wheels could not be coupled. Therefore a flexible 0 : 6 : 2 tank locomotive was designed, with a rigid wheelbase of only 11-ft. and with ample side play for the trailing axle. The total weight is 65 tons, and of this just over 49 tons rests on the coupled wheels.



The new locomotive shunting at Calcutta Docks

Tests have shown the locomotives of this design to be capable of meeting all the specified conditions. Generally, however, trains of 40 to 46 wagons, weighing 830 to 840 tons, are the day-by-day weights, and these are handled from the East Yard to the Sugar Sheds and between the Old and New Grids; six hours of continuous shunting of this nature requires a coal consumption of only 15 cwts. and a water consumption of about 1,000 gallons. With 45 loaded coal wagons and five other vans, totalling 1,040 tons, a steam cut-off of 65 per cent. is enough to enable the load to be drawn round the sharpest curves with ease, and the chief mechanical engineer of the Port of Calcutta Commissioners considers a load of 25 per cent. greater than this to be feasible.

The locomotives have non-superheated boilers working at a pressure of 210 lb. per sq. in., and with a grate of 18 sq. ft. area capable of burning low-grade Indian coal. The evaporative heating surface is 1,030 sq. ft. The 3-ft. 10-in. coupled wheels are driven by two 16-in. by 24-in. cylinders, and at 75 per cent. of the boiler pressure the tractive effort is 21,000 lbs. About 2,000 galls. of water is carried in the side and rear tanks, and 2½ tons of coal in the bunker. Braking is applied to the coupled wheels only by a steam brake, but vacuum equipment is incorporated to operate the train brakes. Compared with the previous locomotives, these new machines represent an increase of 33 per cent. in haulage capacity.

Tees Conservancy Commission

Scheme for Co-operation with The Hartlepools

Mr. G. R. Strauss, Parliamentary Secretary, Ministry of Transport, and members of the Hartlepools Port and Harbour Commission, were the principal guests of the Tees Conservancy Commission on the occasion of the annual inspection of the River Tees which was held on the 23rd ultimo. At the luncheon which followed, the Chairman, Mr. George West Byng, announced that provisional agreement had been reached for closer co-operation with the port of The Hartlepools.

Proposing the toast of " Our Guests," Mr. Byng said now they had made this trip on the Tees they would understand the natural pride which Tees-siders take in their river. The conversion of the tortuous stream of a century ago into the present broad navigable channel was a constant reminder of the energy and foresight of their predecessors. They were very conscious of their responsibility not only to maintain but to improve upon the progressive development of the last 100 years.

Some four years ago it was realised that energetic steps were necessary if the River Tees, suffering from lack of unification of control and authority, was to meet effectively the conditions of the post-war world. Their efforts culminated in an Act of Parliament after careful examination of their proposals by Committees in both Houses. The position to-day was that they had been authorised to embark on the construction of an oil berth and lay-by berth at Teesport, the site of their proposed new docks, and the work was actually in hand, but it would appear that although they had completed their plans, including the provision of all the necessary finance, the general economic position—particularly in respect of shortages of labour and materials—was temporarily holding up the granting of authority for the construction of the new dock itself, which they considered to be a development of the utmost importance to Tees-side. It was hoped, however, that the position would be eased before long and that they would be enabled to proceed with the improved dock facilities authorised by Parliament, as they held the view that this project was one where the circumstances were such as to justify the work being undertaken without delay. Unfortunately, however, no matter how strong they considered their case to be, the decision did not rest with them.

Productive Efficiency Essential

Mr. Byng thought that by now it must be clear to everyone that with the present high cost of raw materials and the existing level of wages, our hope as a nation of obtaining our proper share in the world's international markets depended in a large measure upon raising the productive efficiency and exporting power of the country. It was with increased efficiency in view and in the national interest that the Commissioners put forward their proposals which will result in much desired economies in cargo-handling and in a quicker turn-round of shipping.

A question which was constantly in his mind was whether adequate attention is being paid to this important aspect of our national economy. So often has attention been called to the increasing amount of time which ships have to spend in ports. Complaint after complaint was brought to their notice of delays and the heavy charges which follow in their wake. If he could believe what he heard and read, our import and export trades are seriously handicapped by the lack of up-to-date shipping facilities, and it seemed to him that there was tremendous scope for improved efficiency in this connection, and that wise direction and wise spending on improved shipping facilities would materially reduce the charges which our exports had to bear. That would be a definite contribution to the efforts which the country was now called upon to make in order to secure larger overseas markets upon which its very existence depended.

Agreement with the Hartlepools

Continuing, Mr. Byng said before paying his tribute to Mr. George Strauss, Parliamentary Secretary to the Ministry of Transport, he would like to refer to other guests, particularly the

Tees Conservancy Commission—continued

members of the Hartlepools Port and Harbour Commission, who, like Mr. Strauss, were making their first official inspection of the River Tees, and it was a happy augury for the future development of the Tees Estuary that they were with them to-day.

The two Authorities had for some time past been discussing the advantages of closer co-operation and co-ordination of their mutual interests in the development of shipping and industrial facilities in the river and estuary. Two special Sub-Committees recently reported to their respective Boards that in their unanimous view closer working arrangements were desirable in the best interests of the area as a whole, and subsequently, the two Boards agreed that a Joint Committee should be set up with the object of implementing the recommendations of the Sub-Committees. It was appreciated that co-operation between these neighbouring ports would greatly assist in the planning of economic development, minimise wasteful port competition, enable economies to be effected in many directions (including such matters as avoidance of duplication of expensive mobile plant and equipment), improve the operation of shipping facilities resulting in a quicker turn-round of vessels and ultimately lead to a service of the highest efficiency at the lowest cost. They were not overlooking the fact that a scheme such as that envisaged would require consideration in accordance with the terms of Clause 66 of the Transport Act.

Minister's Reply

In reply, Mr. Strauss said that although the Tees Conservancy Commission was nearly 100 years old, it had all the vigour and vitality of youth. He congratulated the Commission on the approval of their docks survey, which had been accepted by Parliament after considerable discussion. It was undoubtedly a scheme which would bring very great benefits not only to the district, but to the nation as a whole. All these schemes, not only theirs, but those which other authorities had at heart, were being carefully examined to decide which might go forward. He could only hope that their major developments would not be long deferred. Whatever their disagreements, he was sure they were agreed that they must never again let a district such as Tees-side suffer 50 per cent. unemployment. Everything that could be done by developments must be done in order that they might flourish not only in times of prosperity but also in times of depression should they come. The Government were devoting a great deal of thought so that new industries were established in depressed areas, and he was sure that in that aspect of their policy they had the whole-hearted approval of all.

He was glad to hear of the proposed working arrangement between the Tees Conservancy Commission and the Hartlepools Port and Harbour Commission. That was just the sort of co-operation which they felt to be exceedingly desirable and which they arranged in the Transport Bill as being likely to lead to increased efficiency.

Publications Received

A hand book entitled **An Introduction to Engineering Economics for Civil Engineering Students,** has been issued by the Post-War National Development Committee of the Institution of Civil Engineers primarily for civil engineering students to enable them to appreciate more fully the application of economics to their professional work.

The hand book deals first with the promoter's interest in economics and then refers to the necessity for an understanding of the fundamental mechanism of finance if the engineer is to apply his technical experience with economic advantage.

In connection with the mechanism of valuations the assessment of values must take into account both cost and life. Considerations of cost alone with a disregard of life may result in mere cheapness which is not necessarily a true criterion of value. Various factors which have to be taken into consideration such as depreciation, maintenance, running costs, overhead charges, etc., are discussed.

After dealing with the civil engineer's use of the economic mechanism in connection with requirements, planning and design, construction, guarantees and tolerance, tender particulars and mathematical solutions, a number of problems and examples are given and solutions are worked out so that the student can appreciate how the principles laid down in the hand book should be applied to meet various definite problems.

The hand book ends with some valuation tables and an appendix dealing with mathematical derivations. It is issued at the price of one shilling.

British Coaster, 1939-1945, published by H.M. Stationery Office, price 1s. 6d., has been prepared by the Central Office of Information for the Ministry of Transport, and is an important, as well as a stirring contribution to the series of official booklets about the War. The part which the little ships played in the struggle has never been forgotten, but here for the first time, a coherent story of the coasters at war has been brought between the covers of an official booklet.

Dunkirk was, perhaps, the most striking epic in the war-time story of the coasters. The channel battles, the dramatic dashes through the Skagerrak to fetch vital supplies from Sweden, and D-Day, when a coaster fleet of 420 craft was mustered, are other outstanding features in the story of the coasters; but in this booklet the less spectacular background is filled in to complete the story of the valuable and gallant part which the tramps and the tankers played between 1939 and 1945.

Despite losses from enemy action and the demands made upon the coaster fleet by the fighting services, the work of carrying cargoes round the coasts of Great Britain did not falter, and every year throughout the war more than thirty million tons of vital merchandise was discharged at the many ports, both large and small, in the United Kingdom.

We have received from the Renold & Coventry Chain Coy., Ltd., Didsbury, Manchester, a copy of their new publication **Renold Chains for Adaptability and Versatility.** This 20 pp. booklet, Ref. No. 316-211, gives clearly illustrated examples of the many uses to which Renold chains can be put. Copies are available on request.